SIEMENS

RUGGEDCOM ROS v5.0

User Guide

For RMC8388

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Table of Contents

Preface

This guide describes v5.0 of ROS (Rugged Operating System) running on the RUGGEDCOM RMC8388. It contains instructions and guidelines on how to use the software, as well as some general theory.

It is intended for use by network technical support personnel who are familiar with the operation of networks. It is also recommended for use by network and system planners, system programmers, and line technicians.

IMPORTANT!
Some of the parameters and options described may not be available depending on variations in the device hardware. While every attempt is made to accurately describe the specific parameters and options available, this Guide should be used as a companion to the Help text included in the software.

CONTENTS

Conventions

This User Guide uses the following conventions to present information clearly and effectively.

Alerts

The following types of alerts are used when necessary to highlight important information.

DANGER!
DANGER alerts describe imminently hazardous situations that, if not avoided, will result in death or serious injury.

WARNING!
WARNING alerts describe hazardous situations that, if not avoided, may result in serious injury and/or equipment damage.

CAUTION!
CAUTION alerts describe hazardous situations that, if not avoided, may result in equipment damage.

IMPORTANT!
IMPORTANT alerts provide important information that should be known before performing a procedure or step, or using a feature.

NOTE
NOTE alerts provide additional information, such as facts, tips and details.

CLI Command Syntax

The syntax of commands used in a Command Line Interface (CLI) is described according to the following conventions:

Example	Description
command	Commands are in bold.
command parameter	Parameters are in plain text.
command parameter1 parameter2	Parameters are listed in the order they must be entered.
command parameter1 *parameter2*	Parameters in italics must be replaced with a user-defined value.
command [parameter1 | parameter2]	Alternative parameters are separated by a vertical bar (|). Square brackets indicate a required choice between two or more parameters.
command { parameter3 | parameter4 }	Curly brackets indicate an optional parameter(s).
command parameter1 parameter2 { parameter3 | parameter4 }	All commands and parameters are presented in the order they must be entered.

Related Documents

Other documents that may be of interest include:

- *RUGGEDCOM RMC8388 Installation Guide*

System Requirements

Each workstation used to connect to the RUGGEDCOM ROS interface must meet the following system requirements:

- Must have one of the following Web browsers installed:
  - Microsoft Internet Explorer 8.0 or higher
  - Mozilla Firefox
  - Google Chrome
  - Iceweasel/IceCat (Linux Only)
- Must have a working Ethernet interface compatible with at least one of the port types on the RUGGEDCOM device

- The ability to configure an IP address and netmask on the computer's Ethernet interface

Accessing Documentation

The latest user documentation for RUGGEDCOM ROS v5.0 is available online at www.siemens.com/ruggedcom. To request or inquire about a user document, contact Siemens Customer Support.

Training

Siemens offers a wide range of educational services ranging from in-house training of standard courses on networking, Ethernet switches and routers, to on-site customized courses tailored to the customer's needs, experience and application.

Siemens' Educational Services team thrives on providing our customers with the essential practical skills to make sure users have the right knowledge and expertise to understand the various technologies associated with critical communications network infrastructure technologies.

Siemens' unique mix of IT/Telecommunications expertise combined with domain knowledge in the utility, transportation and industrial markets, allows Siemens to provide training specific to the customer's application.

For more information about training services and course availability, visit www.siemens.com/ruggedcom or contact a Siemens Sales representative.

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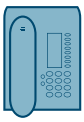
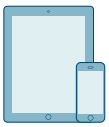
Online

Visit http://www.siemens.com/automation/support-request to submit a Support Request (SR) or check on the status of an existing SR.



Telephone

Call a local hotline center to submit a Support Request (SR). To locate a local hotline center, visit http://www.automation.siemens.com/mcms/aspa-db/en/automation-technology/Pages/default.aspx .



Mobile App

Install the Industry Online Support app by Siemens AG on any Android, Apple iOS or Windows mobile device and be able to:

- Access Siemens' extensive library of support documentation, including FAQs and manuals
- Submit SRs or check on the status of an existing SR
- Contact a local Siemens representative from Sales, Technical Support, Training, etc.
- Ask questions or share knowledge with fellow Siemens customers and the support community

1 Introduction

Welcome to the RUGGEDCOM ROS v5.0 Software User Guide for the RUGGEDCOM RMC8388 devices. This Guide describes the wide array of carrier grade features made available by RUGGEDCOM ROS (Rugged Operating System).

This chapter provides a basic overview of the RUGGEDCOM ROS software.

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Section 1.1

Features and Benefits

The following describes the many features available in RUGGEDCOM ROS and their benefits:

- **Cyber Security Features**
  Cyber security is an urgent issue in many industries where advanced automation and communications networks play a crucial role in mission critical applications and where high reliability is of paramount importance. Key RUGGEDCOM ROS features that address security issues at the local area network level include:

Passwords	Multi-level user passwords secures against unauthorized configuration
SSH/SSL	Extends capability of password protection to add encryption of passwords and data as they cross the network
Enable/Disable Ports	Capability to disable ports so that traffic cannot pass
802.1Q VLAN	Provides the ability to logically segregate traffic between predefined ports on switches
SNMPv3	Encrypted authentication and access security
HTTPS	For secure access to the Web interface

- **Simple Network Management Protocol (SNMP)**
  SNMP provides a standardized method, for network management stations, to interrogate devices from different vendors. SNMP versions supported by RUGGEDCOM ROS are v1, v2c and v3. SNMPv3 in particular provides security features (such as authentication, privacy, and access control) not present in earlier SNMP versions. RUGGEDCOM ROS also supports numerous standard MIBs (Management Information Base) allowing for easy

integration with any Network Management System (NMS). A feature of SNMP is the ability to generate *traps* upon system events. RUGGEDCOM NMS, the Siemens management solution, can record traps from multiple devices providing a powerful network troubleshooting tool. It also provides a graphical visualization of the network and is fully integrated with all Siemens products.

- **Remote Monitoring and Configuration with RUGGEDCOM NMS**
  RUGGEDCOM NMS (RNMS) is Siemens's Network Management System software for the discovery, monitoring and management of RUGGEDCOM products and other IP enabled devices on a network. This highly configurable, full-featured product records and reports on the availability and performance of network components and services. Device, network and service failures are quickly detected and reported to reduce downtime.

  RNMS is especially suited for remotely monitoring and configuring RUGGEDCOM routers, switches, serial servers and WiMAX wireless network equipment. For more information, contact a Siemens Sales representative.
- **NTP (Network Time Protocol)**
  NTP automatically synchronizes the internal clock of all RUGGEDCOM ROS devices on the network. This allows for correlation of time stamped events for troubleshooting.
- **Broadcast Storm Protection**
  Broadcast storms wreak havoc on a network and can cause attached devices to malfunction. This could be disastrous on a network with mission critical equipment. RUGGEDCOM ROS limits this by filtering broadcast frames via software.
- **Event Logging and Alarms**
  RUGGEDCOM ROS records all significant events to a non-volatile system log allowing forensic troubleshooting. Events include link failure and recovery, unauthorized access, broadcast storm detection, and self-test diagnostics among others. Alarms provide a snapshot of recent events that have yet to be acknowledged by the network administrator. An external hardware relay is de-energized during the presence of critical alarms, allowing an external controller to react if desired.
- **HTML Web Browser User Interface**
  RUGGEDCOM ROS provides a simple, intuitive user interface for configuration and monitoring via a standard graphical Web browser or via a standard telcom user interface. All system parameters include detailed online help to facilitate setup and configuration. RUGGEDCOM ROS presents a common look and feel and standardized configuration process, allowing easy migration to other managed RUGGEDCOM products.
- **Brute Force Attack Prevention**
  Protection against Brute Force Attacks (BFAs) is standard in RUGGEDCOM ROS. If an external host fails to log in to the Terminal or Web interfaces after a fixed number of attempts, the service will be blocked for one hour.

Section 1.2

Security Recommendations

To prevent unauthorized access to the device, note the following security recommendations:

Authentication

- Replace the default passwords for all user accounts and processes (where applicable) before the device is deployed.
- Use strong passwords with high randomization (i.e. entropy), without repetition of characters. Avoid weak passwords such as *password1*, *123456789*, *abcdefgh*, and any dictionary words or proper names in any combination. For more information about creating strong passwords, refer to the password requirements in Section 4.3, “Configuring Passwords” .

- Make sure passwords are protected and not shared with unauthorized personnel.
- Passwords should not be re-used across different user names and systems, or after they expire.
- If RADIUS authentication is done remotely, make sure all communications are within the security perimeter or on a secure channel.
- Generate and provision a custom SSL certificate and SSH host key pair before commissioning the device. For more information, refer to Section 3.4, "Managing SSH and SSL Keys and Certificates" .
- Use SSH public key authentication. For more information, refer to Section 3.4, "Managing SSH and SSL Keys and Certificates" .

Physical/Remote Access

- Do not connect the device to the Internet. Deploy the device only within a secure network perimeter.
- Restrict physical access to the device to only authorized personnel. A person with malicious intent could extract critical information, such as certificates, keys, etc. (user passwords are protected by hash codes), or reprogram the device.
- Control access to the serial console to the same degree as any physical access to the device. Access to the serial console allows for potential access to the RUGGEDCOM ROS boot loader, which includes tools that may be used to gain complete access to the device.
- Only enable services that will be used on the device, including physical ports. Unused physical ports could potentially be used to gain access to the network behind the device.
- If SNMP is enabled, limit the number of IP addresses that can connect to the device and change the community names. Also configure SNMP to raise a trap upon authentication failures. For more information, refer to Section 5.2, "Managing SNMP" .
- Avoid using insecure services such as Telnet and TFTP, or disable them completely if possible. These services are available for historical reasons and are disabled by default.
- Limit the number of simultaneous Web Server, Telnet and SSH sessions allowed.
- Configure remote system logging to forward all logs to a central location. For more information, refer to Section 3.6, "Managing Logs" .
- Configuration files are provided in the CSV (comma separated values) format for ease of use. Make sure configuration files are properly protected when they exist outside of the device. For instance, encrypt the files, store them in a secure place, and do not transfer them via insecure communication channels.
- Management of the configuration file, certificates and keys is the responsibility of the device owner. Consider using RSA key sizes of at least 2048 bits in length and certificates signed with SHA256 for increased cryptographic strength. Before returning the device to Siemens for repair, make sure encryption is disabled (to create a cleartext version of the configuration file) and replace the current certificates and keys with temporary *throwaway* certificates and keys that can be destroyed upon the device's return.
- Be aware of any non-secure protocols enabled on the device. While some protocols, such as HTTPS and SSH, are secure, others, such as Telnet and RSH, were not designed for this purpose. Appropriate safeguards against non-secure protocols should be taken to prevent unauthorized access to the device/network.

Hardware/Software

- Make sure the latest firmware version is installed, including all security-related patches. For the latest information on security patches for Siemens products, visit the Industrial Security website [http://www.industry.siemens.com/topics/global/en/industrial-security/news-alerts/Pages/alerts.aspx] or the ProductCERT Security Advisories website [http://www.siemens.com/innovation/en/technology-focus/

siemens-cert/cert-security-advisories.htm] . Updates to Siemens Product Security Advisories can be obtained by subscribing to the RSS feed on the Siemens ProductCERT Security Advisories website, or by following @ProductCert on Twitter.

- Enable BPDU Guard on ports where RSTP BPDUs are not expected.
- Use the latest Web browser version compatible with RUGGEDCOM ROS to make sure the most secure Transport Layer Security (TLS) versions and ciphers available are employed. Additionally, 1/n-1 record splitting is enabled in the latest web browser versions of Mozilla Firefox, Google Chrome and Internet Explorer, and mitigates against attacks such as SSL/TLS Protocol Initialization Vector Implementation Information Disclosure Vulnerability (BEAST) for Non-Controlled (NC) versions of RUGGEDCOM ROS.
- Modbus can be deactivated if not required by the user. If Modbus activation is required, then it is recommended to follow the security recommendations outlined in this User Guide and to configure the environment according to defense-in-depth best practices.
- Prevent access to external, untrusted Web pages while accessing the device via a Web browser. This can assist in preventing potential security threats, such as session hijacking.
- For optimal security, use SNMPv3 whenever possible. Use strong authentication keys and private keys without repetitive strings (e.g. *abc* or *abcabc*) with this feature. For more information about creating strong passwords, refer to the password requirements in Section 4.3, “Configuring Passwords” .

» Policy

- Periodically audit the device to make sure it complies with these recommendations and/or any internal security policies.
- Review the user documentation for other Siemens products used in coordination with device for further security recommendations.

Section 1.3

Supported Networking Standards

The following networking standards are supported by RUGGEDCOM ROS:

Standard	10 Mbps Ports	100 Mbps Ports	1000 Mbps Ports	Notes
IEEE 802.3x	✓	✓	✓	Full Duplex Operation
IEEE 802.3z			✓	1000Base-LX
IEEE 802.3ab			✓	1000Base-Tx
IEEE 802.1D	✓	✓	✓	MAC Bridges
IEEE 802.1Q	✓	✓	✓	VLAN (Virtual LAN)
IEEE 802.1p	✓	✓	✓	Priority Levels

Section 1.4

Available Services by Port

The following table lists the services available under RUGGEDCOM ROS. This table includes the following information:

- **Services**
  The service supported by the device.
- **Port Number**
  The port number associated with the service.
- **Port Open**
  The port state, whether it is always open and cannot be closed, or open only, but can be configured.

> **NOTE**
> *In certain cases, the service might be disabled, but the port can still be open (e.g. TFTP).*

- **Port Default**
  The default state of the port (i.e. open or closed).
- **Access Authorized**
  Denotes whether the ports/services are authenticated during access.

Services	Port Number	Service Enabled/ Disabled	Access Authorized	Note
Telnet	TCP/23	Disabled	Yes	Only available through management interfaces.
HTTP	TCP/80	Enabled (configurable), redirects to 443	—	
HTTPS	TCP/443	Enabled (configurable)	Yes	
RSH	TCP/514	Disabled (configurable)	Yes	Only available through management interfaces.
TFTP	UDP/69	Disabled (configurable)	No	Only available through management interfaces.
SFTP	TCP/22	Enabled	Yes	Only available through management interfaces.
SNMP	UDP/161	Disabled (configurable)	Yes	Only available through management interfaces.
SNTP	UDP/123	Enabled (configurable)	No	Only available through management interfaces.
SSH	TCP/22	Enabled	Yes	Only available through management interfaces.
ICMP	—	Enabled	No	
TACACS+	TCP/49 (configurable)	Disabled (configurable)	Yes	
RADIUS	UDP/1812 to send (configurable), opens random port to listen to	Disabled (configurable)	Yes	Only available through management interfaces.
Remote Syslog	UDP/514 (configurable)	Disabled (configurable)	No	Only available through management interfaces.

Services	Port Number	Service Enabled/ Disabled	Access Authorized	Note
DNP over RawSocket	TCP/21001 to TCP/21016	Disabled (configurable)	No	
DNPv3	UDP/20000 TCP/20000	UDP Disabled (configurable); TCP Enabled (configurable)	No	
RawSocket/Telnet COM	UDP/50001 to UDP/50016 TCP/50001 to TCP/50016	UDP Disabled (configurable); TCP Disabled (configurable)	No	
Preemptive RAW Socket	TCP/62001 to TCP/62016	Disabled (configurable)	No	
TIN	UDP/51000 TCP/51000	UDP Enabled (configurable); TCP Disabled (configurable)	No	
WIN	UDP/52000 TCP/52000	UDP Enabled (configurable); TCP Disabled (configurable)	No	
MICROLOK	UDP/60000	UDP Enabled (configurable); TCP Disabled (configurable)	No	
MirroredBits	UDP/61001 to UDP/61016	Disabled (configurable)	No	
TCP Modbus (Server)	TCP/502	Disabled (configurable)	No	Only available through management interfaces.
TCP Modbus (Switch)	TCP/502	Disabled (configurable)	No	
DHCP, DHCP Agent	UDP/67, 68 sending msg if enabled - if received, always come to CPU, dropped if service not configured	Disabled (configurable)	No	
RCDP	—	Disabled (configurable)	Yes	

Section 1.5

SNMP Management Interface Base (MIB) Support

RUGGEDCOM ROS supports a variety of standard MIBs, proprietary RUGGEDCOM MIBs and Agent Capabilities MIBs, all for SNMP (Simple Network Management Protocol).

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- Section 1.5.3, "Supported Agent Capabilities"

Section 1.5.1
Supported Standard MIBs

RUGGEDCOM ROS supports the following standard MIBs:

Standard	MIB Name	Title
RFC 2578	SNMPv2-SMI	Structure of Management Information Version 2
RFC 2579	SNMPv2-TC	Textual conventions for SMIv2
RFC 2580	SNMPv2-CONF	Conformance statements for SMIv2
	IANAifType	Enumerated values of the ifType Object Defined ifTable defined in IF-MIB
RFC 1907	SNMPv2-MIB	Management Information Base for SNMPv2
RFC 2011	IP-MIB	SNMPv2 Management Information Base for Internet Protocol using SMIv2
RFC 2012	TCP-MIB	SNMPv2 Management Information Base for the Transmission Control Protocol using SMIv2
RFC 2013	UDP-MIB	Management Information Base for the UDP using SMIv2
RFC 1659	RS-232-MIB	Definitions of managed objects for RS-232-like hardware devices
RFC 2863	IF-MIB	The Interface Group MIB
RFC 2819	RMON-MIB	Remote Network Monitoring (RMON) management Information base
RFC 4188	BRIDGE-MIB	Definitions of managed objects for bridges
RFC 4318	RSTP-MIB	Definitions of managed objects for bridges with Rapid Spanning Tree Protocol (RSTP)
RFC 3411	SNMP-FRAMEWORK-MIB	An architecture for describing Simple Network Management Protocol (SNMP) Management Framework
RFC 3414	SNMP-USER-BASED-SM-MIB	User-based Security Model (USM) for Version 3 of the Simple Network Management Protocol (SNMPv3)
RFC 3415	SNMP-VIEW-BASED-ACM-MIB	View-based Access Control Model (VACM) for the Simple Management Protocol (SNMP)
RFC 4363	Q-BRIDGE-MIB	Definitions of Managed Objects for Bridges with traffic classes, multicast filtering, and virtual LAN extensions
IEEE C37.238-2011	IEEEC37.238-MIB	IEEE Standard Profile for use of IEEE 1588 Precision Time Protocol in power system applications

Section 1.5.2
Supported Proprietary RUGGEDCOM MIBs

RUGGEDCOM ROS supports the following proprietary RUGGEDCOM MIBs:

File Name	MIB Name	Description
RUGGEDCOM-MIB.mib	RUGGEDCOM-MIB	RUGGEDCOM enterprise SMI
RUGGEDCOM-TRAPS-MIB.mib	RUGGEDCOM-TRAPS-MIB	RUGGEDCOM traps definition
RUGGEDCOM-SYS-INFO-MIB.mib	RUGGEDCOM-SYS-INFO-MIB	General system information about RUGGEDCOM device
RUGGEDCOM-DOT11-MIB.mib	RUGGEDCOM-DOT11-MIB	Managemet for wireless interface on RUGGEDCOM device
RUGGEDCOM-POE-MIB.mib	RUGGEDCOM-POE-MIB	Management for PoE ports on RUGGEDCOM device
RUGGEDCOM-SERIAL-MIB.mib	RUGGEDCOM-SERIAL-MIB	Managemet for seral ports on RUGGEDCOM device
RUGGEDCOM-STP-MIB.mib	RUGGEDCOM-STP-MIB	Management for RSTP protocol
RUGGEDCOM-IRIGB-MIB.mib	RUGGEDCOM-IRIGB-MIB	RUGGEDCOM proprietary MIB to control and monitor IRIG-B module
RUGGEDCOM-NTP-MIB.mib	RUGGEDCOM-NTP-MIB	RUGGEDCOM proprietary MIB to control and monitor NTP module
RUGGEDCOM-PTP1588-MIB.mib	RUGGEDCOM-PTP1588-MIB	RUGGEDCOM proprietary MIB to control and monitor PTP1588 module
RUGGEDCOM-TIMECONFIG-MIB.mib	RUGGEDCOM-TIMECONFIG-MIB	RUGGEDCOM proprietary MIB to control and monitor TIMECONFIG module

Section 1.5.3

Supported Agent Capabilities

RUGGEDCOM ROS supports the following agent capabilities for the SNMP agent:

NOTE
For information about agent capabilities for SNMPv2, refer to RFC 2580 [http://tools.ietf.org/html/rfc2580].

File Name	MIB Name	Supported MIB
RC-SNMPv2-MIB-AC.mib	RC-SNMPv2-MIB-AC	SNMPv2-MIB
RC-UDP-MIB-AC.mib	RC-UDP-MIB-AC	UDP-MIB
RC-TCP-MIB-AC.mib	RC-TCP-MIB-AC	TCP-MIB
RC-SNMP-USER-BASED-SM-MIB-AC.mib	RC-SNMP-USER-BASED-SM-MIB-AC	SNMP-USER-BASED-SM-MIB-AC
RC-SNMP-VIEW-BASED-ACM-MIB-AC.mib	RC-SNMP-VIEW-BASED-ACM-MIB-AC	SNMP-VIEW-BASED-ACM-MIB-AC
RC-IF-MIB-AC.mib	RC-IF-MIB-AC	IF-MIB
RC-BRIDGE-MIB-AC.mib	RC-BRIDGE-MIB-AC	BRIDGE-MIB
RC-RMON-MIB-AC.mib	RC-RMON-MIB-AC	RMON-MIB
RC-Q-BRIDGE-MIB-AC.mib	RC-Q-BRIDGE-MIB-AC	Q-BRIDGE-MIB
RC-IP-MIB-AC.mib	RC-IP-MIB-AC	IP-MIB

File Name	MIB Name	Supported MIB
RC-LLDP-MIB-AC.mib	RC-LLDP-MIB-AC	LLDP-MIB
RC-LAG-MIB-AC.mib	RC-LAG-MIB-AC	IEEE8023-LAG-MIB
RC_RSTP-MIB-AC.mib	RC_RSTP-MIB-AC	RSTP-MIB
RC-RUGGEDCOM-DOT11-MIB-AC.mib	RC-RUGGEDCOM-DOT11-MIB-AC	RUGGEDCOM-DOT11- MIB
RC-RUGGEDCOM-POE-MIB-AC.mib	RC-RUGGEDCOM-POE-MIB-AC	RUGGEDCOM-POE-MIB
RC-RUGGEDCOM-STP-AC-MIB.mib	RC-RUGGEDCOM-STP-AC-MIB	RUGGEDCOM-STP-MIB
RC-RUGGEDCOM-SYS-INFO-MIB-AC.mib	RC-RUGGEDCOM-SYS-INFO-MIB-AC	RUGGEDCOM-SYS-INFO-MIB
RC-RUGGEDCOM-TRAPS-MIB-AC.mib	RC-RUGGEDCOM-TRAPS-MIB-AC	RUGGEDCOM-TRAPS-MIB
RUGGEDCOM_RS-232-MIB-AC.mib	RUGGEDCOM_RS-232-MIB-AC	RS-232-MIB
RC-RUGGEDCOM-SERIAL-MIB-AC.mib	RC-RUGGEDCOM-SERIAL-MIB-AC	RUGGEDCOM-SERIAL-MIB
RC-IRIGB-MIB-AC.mib	RC-IRIGB-MIB-AC	IRIGB-MIB
RC-NTP-MIB-AC.mib	RC-NTP-MIB-AC	NTP-MIB
RC-PTP1588-MIB-AC.mib	RC-PTP1588-MIB-AC	PTP1588-MIB
RC-TIMECONFIG-MIB-AC.mib	RC-TIMECONFIG-MIB-AC	TIMECONFIG-MIB

Section 1.6
SNMP Traps

The device generates the following standard traps:

Table: Standard Traps

Trap	MIB
linkDown	IF-MIB
linkUp	
authenticationFailure	SNMPv2-MIB
coldStart	
newRoot	BRIDGE-MIB
topologyChage	
risingAlarm	RMON-MIB
fallingAlarm	
lldpRemoteTablesChange	LLDP-MIB

The device also generates the following proprietary traps:

Table: Proprietary Traps

Trap	MIB
genericTrap	RUGGEDCOM-TRAPS-MIB

Trap	MIB
powerSupplyTrap	
swUpgradeTrap	
cfgChangeTrap	
weakPasswordTrap	
defaultKeysTrap	

Generic traps carry information about events in their severity and description objects. They are sent at the same time an alarm is generated for the device. The following are examples of RUGGEDCOM generic traps:

NOTE
Information about generic traps can be retrieved using the CLI command **`alarms`**. *For more information about the* **`alarms`** *command, refer to* *Section 2.6.1, "Available CLI Commands"* .

Table: Generic Traps

Trap	Severity
heap error	Alert
NTP server failure	notification
real time clock failure	Error
failed password	Warning
MAC address not learned by switch fabric	Warning
BootP client: TFTP transfer failure	Error
received looped back BPDU	Error
received two consecutive confusing BPDUs on port, forcing down	Error

The device generates the following traps when specific events occur:

Table: Event-Based Traps

Trap	MIB	Event
rcRstpNewTopology	RUGGEDCOM-STP-MIB	This trap is generated when the device topology becomes stable after a topology change occurs on a switch port.
rcIrigbStatusChange	RUGGEDCOM-IRIGB-MIB.mib	This trap is generated if the status of the IRIG-B module is changed.
ieeeC37238EventOfstExceedLimit	IEEEC37-238-MIB.mib	This trap is generated if the offset from Master of the IEEE 1588 Slave exceeds the configured limit.
ieeeC37238EventChangeOfMaster	IEEEC37-238-MIB.mib	This trap is generated if new master has been selected.
ieeeC37238EventMasterStepChange	IEEEC37-238-MIB.mib	This trap is generated if a step change occurred in current grandmaster time.
ieeeC37238EventPTPServiceStarted	IEEEC37-238-MIB.mib	This trap is generated if PTP service has started.
ieeeC37238EventPTPServiceStopped	IEEEC37-238-MIB.mib	This trap is generated if PTP service has stopped.

Section 1.7

Modbus Management Support

Modbus management support in RUGGEDCOM devices provides a simple interface for retrieving basic status information. ModBus support simplifies the job of SCADA (Supervisory Control and Data Acquisition) system integrators by providing familiar protocols for retrieving RUGGEDCOM device information. ModBus provides mostly read-only status information, but there are some writable registers for operator commands.

The ModBus protocol PDU (Protocol Data Unit) format is as follows:

Function Code	Data

CONTENTS

Section 1.7.1

ModBus Function Codes

RUGGEDCOM devices support the following ModBus function codes for device management through ModBus:

NOTE

While RUGGEDCOM devices have a variable number of ports, not all registers and bits apply to all products.

Registers that are not applicable to a particular device return a zero (0) value. For example, registers referring to serial ports are not applicable to RUGGEDCOM switch devices.

» Read Input Registers or Read Holding Registers — 0x04 or 0x03

Example PDU Request

Function Code	1 Byte	0x04(0x03)
Starting Address	2 Bytes	0x0000 to 0xFFFF (Hexadecimal) 128 to 65535 (Decimal)
Number of Input Registers	2 Bytes	Bytes 0x0001 to 0x007D

Example PDU Response

Function Code	1 Byte	0x04(0x03)
Byte Count	1 Byte	2 x *N* [a]
Number of Input Registers	*N* [a] x 2 Bytes	

[a] *The number of input registers*

Write Multiple Registers — 0x10

Example PDU Request

Function Code	1 Byte	0x10
Starting Address	2 Bytes	0x0000 to 0xFFFF
Number of Input Registers	2 Bytes	Bytes 0x0001 to 0x0079
Byte Count	1 Byte	2 x *N* [b]
Registers Value	*N* [b] x 2 Bytes	Value of the register

[b] *The number of input registers*

Example PDU Response

Function Code	1 Byte	0x10
Starting Address	2 Bytes	0x0000 to 0xFFFF
Number of Registers	2 Bytes	1 to 121 (0x79)

Section 1.7.2

ModBus Memory Map

The following details how ModBus process variable data is mapped.

Product Info

The following data is mapped to the *Productinfo* table:

Address	#Registers	Description (Reference Table in UI)	R/W	Format
0000	16	Product Identification	R	Text
0010	32	Firmware Identification	R	Text
0040	1	Number of Ethernet Ports	R	Uint16
0041	1	Number of Serial Ports	R	Uint16
0042	1	Number of Alarms	R	Uint16
0043	1	Power Supply Status	R	PSStatusCmd
0044	1	FailSafe Relay Status	R	TruthValue
0045	1	ErrorAlarm Status	R	TruthValue

Product Write Register

The following data is mapped to various tables:

Address	#Registers	Description (Reference Table in UI)	R/W	Format
0080	1	Clear Alarms	W	Cmd
0081	2	Reset Ethernet Ports	W	PortCmd

Address	#Registers	Description (Reference Table in UI)	R/W	Format
0083	2	Clear Ethernet Statistics	W	PortCmd
0085	2	Reset Serial Ports	W	PortCmd
0087	2	Clear Serial Port Statistics	W	PortCmd

Alarms

The following data is mapped to the *alarms* table:

Address	#Registers	Description (Reference Table in UI)	R/W	Format
0100	64	Alarm 1	R	Alarm
0140	64	Alarm 2	R	Alarm
0180	64	Alarm 3	R	Alarm
01C0	64	Alarm 4	R	Alarm
0200	64	Alarm 5	R	Alarm
0240	64	Alarm 6	R	Alarm
0280	64	Alarm 7	R	Alarm
02C0	64	Alarm 8	R	Alarm

Ethernet Port Status

The following data is mapped to the *ethPortStats* table:

Address	#Registers	Description (Reference Table in UI)	R/W	Format
03FE	2	Port Link Status	R	PortCmd

Ethernet Statistics

The following data is mapped to the *rmonStats* table:

Address	#Registers	Description (Reference Table in UI)	R/W	Format
0400	2	Port s1/p1 Statistics - Ethernet In Packets	R	Uinst32
0402	2	Port s1/p2 Statistics - Ethernet In Packets	R	Uinst32
0404	2	Port s1/p3 Statistics - Ethernet In Packets	R	Uinst32
0406	2	Port s1/p4 Statistics - Ethernet In Packets	R	Uinst32
0408	2	Port s2/p1 Statistics - Ethernet In Packets	R	Uinst32
040A	2	Port s2/p2 Statistics - Ethernet In Packets	R	Uinst32
040C	2	Port s2/p3 Statistics - Ethernet In Packets	R	Uinst32
040E	2	Port s2/p4 Statistics - Ethernet In Packets	R	Uinst32
0410	2	Port s3/p1 Statistics - Ethernet In Packets	R	Uinst32
0412	2	Port s3/p2 Statistics - Ethernet In Packets	R	Uinst32

Address	#Registers	Description (Reference Table in UI)	R/W	Format
0414	2	Port s3/p3 Statistics - Ethernet In Packets	R	Uinst32
0416	2	Port s3/p4 Statistics - Ethernet In Packets	R	Uinst32
0418	2	Port s4/p1 Statistics - Ethernet In Packets	R	Uinst32
041A	2	Port s4/p2 Statistics - Ethernet In Packets	R	Uinst32
041C	2	Port s4/p3 Statistics - Ethernet In Packets	R	Uinst32
041E	2	Port s4/p4 Statistics - Ethernet In Packets	R	Uinst32
0420	2	Port s5/p1 Statistics - Ethernet In Packets	R	Uinst32
0422	2	Port s5/p2 Statistics - Ethernet In Packets	R	Uinst32
0424	2	Port s5/p3 Statistics - Ethernet In Packets	R	Uinst32
0426	2	Port s5/p4 Statistics - Ethernet In Packets	R	Uinst32
0428	2	Port s6/p1 Statistics - Ethernet In Packets	R	Uinst32
042A	2	Port s6/p2 Statistics - Ethernet In Packets	R	Uinst32
042C	2	Port s6/p3 Statistics - Ethernet In Packets	R	Uinst32
042E	2	Port s6/p4 Statistics - Ethernet In Packets	R	Uinst32
0430	2	Port s7/p1 Statistics - Ethernet In Packets	R	Uinst32
0432	2	Port s7/p2 Statistics - Ethernet In Packets	R	Uinst32
0434	2	Port s8/p1 Statistics - Ethernet In Packets	R	Uinst32
0436	2	Port s8/p2 Statistics - Ethernet In Packets	R	Uinst32
0440	2	Port s1/p1 Statistics - Ethernet Out Packets	R	Uinst32
0442	2	Port s1/p2 Statistics - Ethernet Out Packets	R	Uinst32
0444	2	Port s1/p3 Statistics - Ethernet Out Packets	R	Uinst32
0446	2	Port s1/p4 Statistics - Ethernet Out Packets	R	Uinst32
0448	2	Port s2/p1 Statistics - Ethernet Out Packets	R	Uinst32
044A	2	Port s2/p2 Statistics - Ethernet Out Packets	R	Uinst32
044C	2	Port s2/p3 Statistics - Ethernet Out Packets	R	Uinst32
044E	2	Port s2/p4 Statistics - Ethernet Out Packets	R	Uinst32
0450	2	Port s3/p1 Statistics - Ethernet Out Packets	R	Uinst32
0452	2	Port s3/p2 Statistics - Ethernet Out Packets	R	Uinst32
0454	2	Port s3/p3 Statistics - Ethernet Out Packets	R	Uinst32
0456	2	Port s3/p4 Statistics - Ethernet Out Packets	R	Uinst32
0458	2	Port s4/p1 Statistics - Ethernet Out Packets	R	Uinst32
045A	2	Port s4/p2 Statistics - Ethernet Out Packets	R	Uinst32
045C	2	Port s4/p3 Statistics - Ethernet Out Packets	R	Uinst32
045E	2	Port s4/p4 Statistics - Ethernet Out Packets	R	Uinst32

Address	#Registers	Description (Reference Table in UI)	R/W	Format
0460	2	Port s5/p1 Statistics - Ethernet Out Packets	R	Uinst32
0462	2	Port s5/p2 Statistics - Ethernet Out Packets	R	Uinst32
0464	2	Port s5/p3 Statistics - Ethernet Out Packets	R	Uinst32
0466	2	Port s5/p4 Statistics - Ethernet Out Packets	R	Uinst32
0468	2	Port s6/p1 Statistics - Ethernet Out Packets	R	Uinst32
046A	2	Port s6/p2 Statistics - Ethernet Out Packets	R	Uinst32
046C	2	Port s6/p3 Statistics - Ethernet Out Packets	R	Uinst32
046E	2	Port s6/p4 Statistics - Ethernet Out Packets	R	Uinst32
0470	2	Port s7/p1 Statistics - Ethernet Out Packets	R	Uinst32
0472	2	Port s7/p2 Statistics - Ethernet Out Packets	R	Uinst32
0474	2	Port s8/p1 Statistics - Ethernet Out Packets	R	Uinst32
0476	2	Port s8/p2 Statistics - Ethernet Out Packets	R	Uinst32
0480	2	Port s1/p1 Statistics - Ethernet In Packets	R	Uinst32
0482	2	Port s1/p2 Statistics - Ethernet In Packets	R	Uinst32
0484	2	Port s1/p3 Statistics - Ethernet In Packets	R	Uinst32
0486	2	Port s1/p4 Statistics - Ethernet In Packets	R	Uinst32
0488	2	Port s2/p1 Statistics - Ethernet In Packets	R	Uinst32
048A	2	Port s2/p2 Statistics - Ethernet In Packets	R	Uinst32
048C	2	Port s2/p3 Statistics - Ethernet In Packets	R	Uinst32
048E	2	Port s2/p4 Statistics - Ethernet In Packets	R	Uinst32
0490	2	Port s3/p1 Statistics - Ethernet In Packets	R	Uinst32
0492	2	Port s3/p2 Statistics - Ethernet In Packets	R	Uinst32
0494	2	Port s3/p3 Statistics - Ethernet In Packets	R	Uinst32
0496	2	Port s3/p4 Statistics - Ethernet In Packets	R	Uinst32
0498	2	Port s4/p1 Statistics - Ethernet In Packets	R	Uinst32
049A	2	Port s4/p2 Statistics - Ethernet In Packets	R	Uinst32
049C	2	Port s4/p3 Statistics - Ethernet In Packets	R	Uinst32
049E	2	Port s4/p4 Statistics - Ethernet In Packets	R	Uinst32
04A0	2	Port s5/p1 Statistics - Ethernet In Packets	R	Uinst32
04A2	2	Port s5/p2 Statistics - Ethernet In Packets	R	Uinst32
04A4	2	Port s5/p3 Statistics - Ethernet In Packets	R	Uinst32
04A6	2	Port s5/p4 Statistics - Ethernet In Packets	R	Uinst32
04A8	2	Port s6/p1 Statistics - Ethernet In Packets	R	Uinst32
04AA	2	Port s6/p2 Statistics - Ethernet In Packets	R	Uinst32

Address	#Registers	Description (Reference Table in UI)	R/W	Format
04AC	2	Port s6/p3 Statistics - Ethernet In Packets	R	Uinst32
04AE	2	Port s6/p4 Statistics - Ethernet In Packets	R	Uinst32
04B0	2	Port s7/p1 Statistics - Ethernet In Packets	R	Uinst32
04B2	2	Port s7/p2 Statistics - Ethernet In Packets	R	Uinst32
04B4	2	Port s8/p1 Statistics - Ethernet In Packets	R	Uinst32
04B6	2	Port s8/p2 Statistics - Ethernet In Packets	R	Uinst32
04C0	2	Port s1/p1 Statistics - Ethernet Out Packets	R	Uinst32
04C2	2	Port s1/p2 Statistics - Ethernet Out Packets	R	Uinst32
04C4	2	Port s1/p3 Statistics - Ethernet Out Packets	R	Uinst32
04C6	2	Port s1/p4 Statistics - Ethernet Out Packets	R	Uinst32
04C8	2	Port s2/p1 Statistics - Ethernet Out Packets	R	Uinst32
04CA	2	Port s2/p2 Statistics - Ethernet Out Packets	R	Uinst32
04CC	2	Port s2/p3 Statistics - Ethernet Out Packets	R	Uinst32
04CE	2	Port s2/p4 Statistics - Ethernet Out Packets	R	Uinst32
04D0	2	Port s3/p1 Statistics - Ethernet Out Packets	R	Uinst32
04D2	2	Port s3/p2 Statistics - Ethernet Out Packets	R	Uinst32
04D4	2	Port s3/p3 Statistics - Ethernet Out Packets	R	Uinst32
04D6	2	Port s3/p4 Statistics - Ethernet Out Packets	R	Uinst32
04D8	2	Port s4/p1 Statistics - Ethernet Out Packets	R	Uinst32
04DA	2	Port s4/p2 Statistics - Ethernet Out Packets	R	Uinst32
04DC	2	Port s4/p3 Statistics - Ethernet Out Packets	R	Uinst32
04DE	2	Port s4/p4 Statistics - Ethernet Out Packets	R	Uinst32
04E0	2	Port s5/p1 Statistics - Ethernet Out Packets	R	Uinst32
04E2	2	Port s5/p2 Statistics - Ethernet Out Packets	R	Uinst32
04E4	2	Port s5/p3 Statistics - Ethernet Out Packets	R	Uinst32
04E6	2	Port s5/p4 Statistics - Ethernet Out Packets	R	Uinst32
04E8	2	Port s6/p1 Statistics - Ethernet Out Packets	R	Uinst32
04EA	2	Port s6/p2 Statistics - Ethernet Out Packets	R	Uinst32
04EC	2	Port s6/p3 Statistics - Ethernet Out Packets	R	Uinst32
04EE	2	Port s6/p4 Statistics - Ethernet Out Packets	R	Uinst32
04F0	2	Port s7/p1 Statistics - Ethernet Out Packets	R	Uinst32
04F2	2	Port s7/p2 Statistics - Ethernet Out Packets	R	Uinst32
04F4	2	Port s8/p1 Statistics - Ethernet Out Packets	R	Uinst32
04F6	2	Port s8/p2 Statistics - Ethernet Out Packets	R	Uinst32

Serial Statistics

The following data is mapped to the *uartPortStatus* table:

Address	#Registers	Description (Reference Table in UI)	R/W	Format
0600	2	Port 1 Statistics – Serial In characters	R	Uint32
0602	2	Port 2 Statistics – Serial In characters	R	Uint32
0604	2	Port 3 Statistics – Serial In characters	R	Uint32
0606	2	Port 4 Statistics – Serial In characters	R	Uint32
0640	2	Port 1 Statistics – Serial Out characters	R	Uint32
0642	2	Port 2 Statistics – Serial Out characters	R	Uint32
0644	2	Port 3 Statistics – Serial Out characters	R	Uint32
0646	2	Port 4 Statistics – Serial Out characters	R	Uint32
0680	2	Port 1 Statistics – Serial In Packets	R	Uint32
0682	2	Port 2 Statistics – Serial In Packets	R	Uint32
0684	2	Port 3 Statistics – Serial In Packets	R	Uint32
0686	2	Port 4 Statistics – Serial In Packets	R	Uint32
06C0	2	Port 1 Statistics – Serial Out Packets	R	Uint32
06C2	2	Port 2 Statistics – Serial Out Packets	R	Uint32
06C4	2	Port 3 Statistics – Serial Out Packets	R	Uint32
06C6	2	Port 4 Statistics – Serial Out Packets	R	Uint32

Section 1.7.3

Modbus Memory Formats

This section defines the Modbus memory formats supported by RUGGEDCOM ROS.

CONTENTS

- Section 1.7.3.8, “TruthValues”

Section 1.7.3.1
Text

The Text format provides a simple ASCII representation of the information related to the product. The most significant register byte of an ASCII characters comes first.

For example, consider a *Read Multiple Registers* request to read Product Identification from location 0x0000.

0x04	0x00	0x00	0x00	0x08

The response may look like:

0x04	0x10	0x53	0x59	0x53	0x54	0x45	0x4D	0x20	0x4E	0x41	0x4D	0x45
0x00	0x00	0x00	0x00	0x00								

In this example, starting from byte 3 until the end, the response presents an ASCII representation of the characters for the product identification, which reads as *SYSTEM NAME*. Since the length of this field is smaller than eight registers, the rest of the field is filled with zeros (0).

Section 1.7.3.2
Cmd

The Cmd format instructs the device to set the output to either *true* or *false*. The most significant byte comes first.

- FF 00 hex requests output to be True
- 00 00 hex requests output to be False
- Any value other than the suggested values does not affect the requested operation

For example, consider a *Write Multiple Registers* request to clear alarms in the device.

0x10	0x00	0x80	0x00	0x01	2	0xFF	0x00

- FF 00 for register 00 80 clears the system alarms
- 00 00 does not clear any alarms

The response may look like:

0x10	0x00	0x80	0x00	0x01

Section 1.7.3.3
Uint16

The Uint16 format describes a Standard ModBus 16 bit register.

Section 1.7.3.4
Uint32

The Uint32 format describes Standard 2 ModBus 16 bit registers. The first register holds the most significant 16 bits of a 32 bit value. The second register holds the least significant 16 bits of a 32 bit value.

Section 1.7.3.5
PortCmd

The PortCmd format describes a bit layout per port, where 1 indicates the requested action is true, and 0 indicates the requested action is false.

PortCmd provides a bit layout of a maximum of 32 ports. Therefore, it uses two ModBus regsiters:

- The first ModBus register corresponds to ports 1 – 16
- The second ModBus register corresponds to ports 17 – 32 for a particular action

Bits that do not apply to a particular product are always set to zero (0).

A bit value of 1 indicates that the requested action is true. For example, the port is *up*.

A bit value of 0 indicates that the requested action is false. For example, the port is *down*.

» Reading Data Using PortCmd

To understand how to read data using PortCmd, consider a ModBus Request to read multiple registers from locatoin 0x03FE.

0x04	0x03	0xFE	0x00	0x02

The response depends on how many parts are available on the device. For example, if the maximum number of ports on a connected RUGGEDCOM device is 20, the response would be similar to the following:

0x04	0x04	0xF2	0x76	0x00	0x05

In this example, bytes 3 and 4 refer to register 1 at location 0x03FE, and represent the status of ports 1 – 16. Bytes 5 and 6 refer to register 2 at location 0x03FF, and represent the status of ports 17 – 32. The device only has 20 ports, so byte 6 contains the status for ports 17 – 20 starting from right to left. The rest of the bites in register 2 corresponding to the non-existing ports 21 – 31 are zero (0).

» Performing Write Actions Using PortCmd

To understand how data is written using PortCmd, consider a Write Multiple Register request to clear Ethernet port statistics:

0x10	0x00	0x83	0x00	0x01	2	0x55	0x76	0x00	0x50

A bit value of 1 clears Ethernet statistics on the corresponding port. A bit value of 0 does not clear the Ethernet statistics.

0x10	0x00	0x81	0x00	0x02

Section 1.7.3.6
Alarm

The Alarm format is another form of text description. Alarm text corresponds to the alarm description from the table holding all of the alarms. Similar to the Text format, this format returns an ASCII representation of alarms.

NOTE
Alarms are stacked in the device in the sequence of their occurence (i.e. Alarm 1, Alarm 2, Alarm 3, etc.).

The first eight alarms from the stack can be returned, if they exist. A zero (0) value is returned if an alarm does not exist.

Section 1.7.3.7
PSStatusCmd

The PSStatusCmd format describes a bit layout for providing the status of available power supplies. Bits 0-4 of the lower byte of the register are used for this purpose.

- Bits 0-1: Power Supply 1 Status
- Bits 2-3: Power Supply 2 Status

Other bits in the register do not provide any system status information.

Bit Value	Description
01	Power Supply not present (01 = 1)
10	Power Supply is functional (10 = 2)
11	Power Supply is not functional (11 = 3)

The values used for power supply status are derived from the RUGGEDCOM-specific SNMP MIB.

» Reading the Power Supply Status from a Device Using PSStatusCmd

To understand how to read the power supply status from a device using PSStatusCmd, consider a ModBus Request to read multiple registers from location 0x0043.

0x04	0x00	0x43	0x00	0x01

The response may look like:

0x04	0x02	0x00	0x0A

The lower byte of the register displays the power supply's status. In this example, both power supplies in the unit are functional.

Section 1.7.3.8
TruthValues

The Truthvalues format represents a true or false status in the device:

- 1 indicates the corresponding status for the device to be true

- 2 indicates the corresponding status for the device to be false

Reading the FailSafe Relay Status From a Device Using TruthValue

To understand how to use the TruthValue format to read the FailSafe Relay status from a device, consider a ModBus request to read multiple registers from location 0x0044.

0x04	0x00	0x44	0x00	0x01

The response may look like:

0x04	0x02	0x00	0x01

The register's lower byte shows the FailSafe Relay status. In this example, the FailSafe Relay is energized.

Reading the ErrorAlarm Status From a Device Using TruthValue

To understand how to use the TruthValue format to read the ErrorAlarm status from a device, conside a ModBus request to read mulitple registers from location 0x0045.

0x04	0x00	0x45	0x00	0x01

The response may look like:

0x04	0x02	0x00	0x01

The register's lower byte shows the ErrorAlarm status. In this example, there is no active ERROR, ALERT or CRITICAL alarm in the device.

2 Using ROS

This chapter describes how to use RUGGEDCOM ROS.

CONTENTS

Section 2.1

Connecting to ROS

This section describes the various methods for connecting to the device.

CONTENTS

Section 2.1.1

Connecting Directly

RUGGEDCOM ROS can be accessed through a direct RS-232 serial console connection for management and troubleshooting purposes. A console connection provides access to the console interface and CLI.

To establish a console connection to the device, do the following:

1. Connect a workstation (either a terminal or computer running terminal emulation software) to the RS-232 serial console port on the device. For more information about the RS-232 serial console port, refer to the *RMC8388 Installation Guide*.

NOTE
The baud rate for the device is printed on the chassis exterior near the RS-232 serial console port.

2. Configure the workstation as follows:
   - Speed (baud): 57600
   - Data Bits: 8
   - Parity: None
   - Flow Control: Off
   - Terminal ID: VT100
   - Stop Bit: 1
3. Make sure power to the device is off or disconnected.
4. Simultaneously power up the device and press **Ctrl-Z** on the workstation. The following message appears:

```
Console mode...
Type 'yes' if you want to enter MAIN console mode:
```

5. Type **yes** and press **Enter** to enter console mode. The login form appears.
6. Log in to the device. For more information about logging in to the device, refer to Section 2.2, "Logging In" .

Section 2.1.2
Connecting via the Network

RUGGEDCOM ROS can be accessed over the network either through a Web browser, terminal or a workstation running terminal emulation software.

Using a Web Browser

Web browsers provide a secure connection to the Web interface for RUGGEDCOM ROS using the SSL (Secure Socket Layer) communication method. SSL encrypts traffic exchanged with its clients.

The RUGGEDCOM ROS Web server guarantees that all communications with the client are private. If a client requests access through an insecure HTTP port, the client is automatically rerouted to the secure port. Access to the Web server through SSL will only be granted to clients that provide a valid user name and password.

To establish a connection through a Web browser, do the following:

1. On the workstation being used to access the device, configure an Ethernet port to use an IP address falling within the subnet of the device. The default IP address is 192.168.0.1/24.

   For example, to configure the device to connect to one of the available Ethernet ports, assign an IP address to the Ethernet port on the workstation in the range of 192.168.0.3 to 192.168.0.254.
2. Open a Web browser. For a list of recommended Web browsers, refer to "System Requirements" .

IMPORTANT!
Upon connecting to the device, some Web browsers may report the Web server's certificate cannot be verified against any known certificates. This is expected behavior, and it is safe to instruct the browser to accept the certificate. Once the certificate is accepted, all communications with the Web server through that browser will be secure.

3. In the address bar, type the IP address for the port that is connected to the network. For example, to access the device using its factory default IP address, type **`https://192.168.0.1`** and press **Enter**. Once the connection is established, the login screen for the Web interface appears.

   For more information about logging in to the device, refer to Section 2.2, "Logging In" . For more information about the Web interface, refer to Section 2.4, "Using the Web Interface" .

» Using a Terminal or Terminal Emulation Software

A terminal or computer running terminal emulation software provides access to the console interface for RUGGEDCOM ROS through a Telnet, RSH (Remote Shell) or SSH (Secure Shell) service.

> **NOTE**
> *IP services can be restricted to control access to the device. For more information, refer to Section 3.9, "Configuring IP Services" .*

To establish a connection through a terminal or terminal emulation software, do the following:

1. Select the service (i.e. Telnet, RSH or SSH).
2. Enter the IP address for the port that is connected to the network.
3. Connect to the device. Once the connection is established, the login form appears. For more information about logging in to the device, refer to Section 2.2, "Logging In" .

Section 2.2

Logging In

To log in to the device, do the following:

1. Connect to the device either directly or through a Web browser. For more information about how to connect to the device, refer to Section 2.1, "Connecting to ROS" .

   Once the connection is established, the login form appears.

Figure 1: SSH Login Screen (Console Interface)

1. User Name Box **2.** Password Box

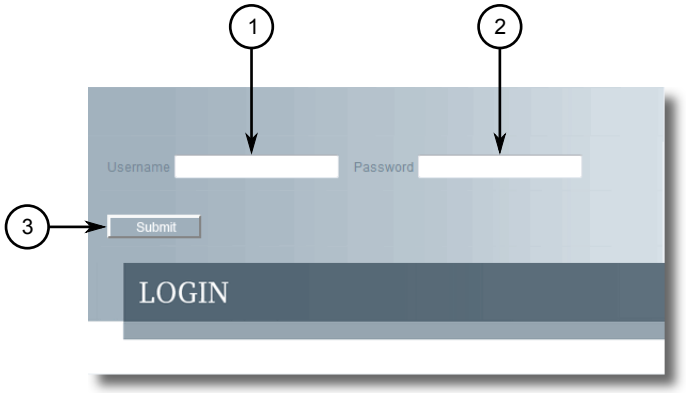


Figure 2: Login Screen (Web Interface)

1. Username Box **2.** Password Box **3.** Submit Button

NOTE

The following default user names and passwords are set on the device for each user type:

Guest	***Operator***	***Admin***
User Name: guest	*User Name: operator*	*User Name: admin*
Password: guest	*Password: operator*	*Password: admin*

CAUTION!

To prevent unauthorized access to the device, make sure to change the default guest, operator, and admin passwords before commissioning the device.

For more information about changing passwords, refer to *Section 4.3, "Configuring Passwords"* .

2. In the **User Name** field, type the user name for an account setup on the device.
3. In the **Password** field, typ the password for the account.
4. Click **Enter** or click **Submit** (Web interface only).

Section 2.3

Logging Out

To log out of the device, navigate to the main screen and do the following:

- To log out of the Console or secure shell interfaces, press **CTRL** + **X**.
- To log out of the Web interface, click **Logout**.

Figure 3: Web Interface (Example)

1. Logout

NOTE

If any pending configuration changes have not been committed, RUGGEDCOM ROS will request confirmation before discarding the changes and logging out of the device.

Section 2.4

Using the Web Interface

The Web interface is a Web-based Graphical User Interface (GUI) for displaying important information and controls in a Web browser. The interface is divided into three frames: the banner, the menu and the main frame.

Figure 4: Web Interface Layout (Example)

1. Top Frame **2.** Side Frame **3.** Main Frame

Frame	Description
Top	The top frame displays the system name for the device.

Frame	Description
Side	The side frame contains a logout option and a collapsible list of links that open various screens in the main frame. For information about logging out of RUGGEDCOM ROS, refer to Section 2.3, "Logging Out" .
Main	The main frame displays the parameters and/or data related to the selected feature.

Each screen consists of a title, the current user's access level, parameters and/or data (in form or table format), and controls (e.g. add, delete, refresh, etc.). The title provides access to context-specific Help for the screen that provides important information about the available parameters and/or data. Click on the link to open the Help information in a new window.

When an alarm is generated, an alarm notification replaces the current user's access level on each screen until the alarm is cleared. The notification indicates how many alarms are currently active. For more information about alarms, refer to Section 4.6, "Managing Alarms" .

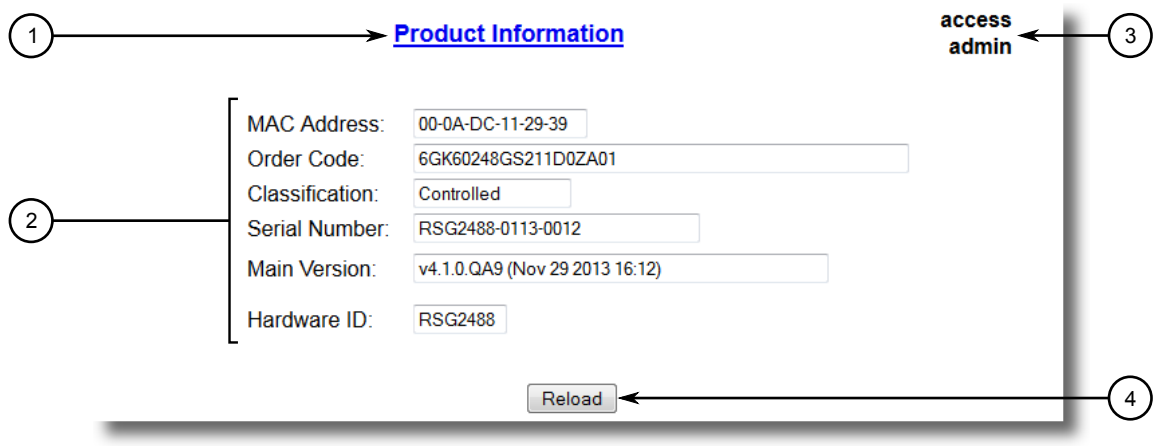


Figure 5: Elements of a Typical Screen (Example)

1. Title **2.** Parameters and/or Data **3.** Access Level or Alarm Notification **4.** Controls

NOTE
If desired, the web interface can be disabled. For more information, refer to Section 4.5, "Enabling/Disabling the Web Interface" .

Section 2.5

Using the Console Interface

The Console interface is a Graphical User Interface (GUI) organized as a series of menus. It is primarily accessible through a serial console connection, but can also be accessed through IP services, such as a Telnet, RSH (Remote Shell), SSH (Secure Shell) session, or SSH remote command execution.

NOTE
IP services can be restricted to control access to the device. For more information, refer to Section 3.9, "Configuring IP Services" .

Each screen consists of a system identifier, the name of the current menu, and a command bar. Alarms are also indicated on each screen in the upper right corner.

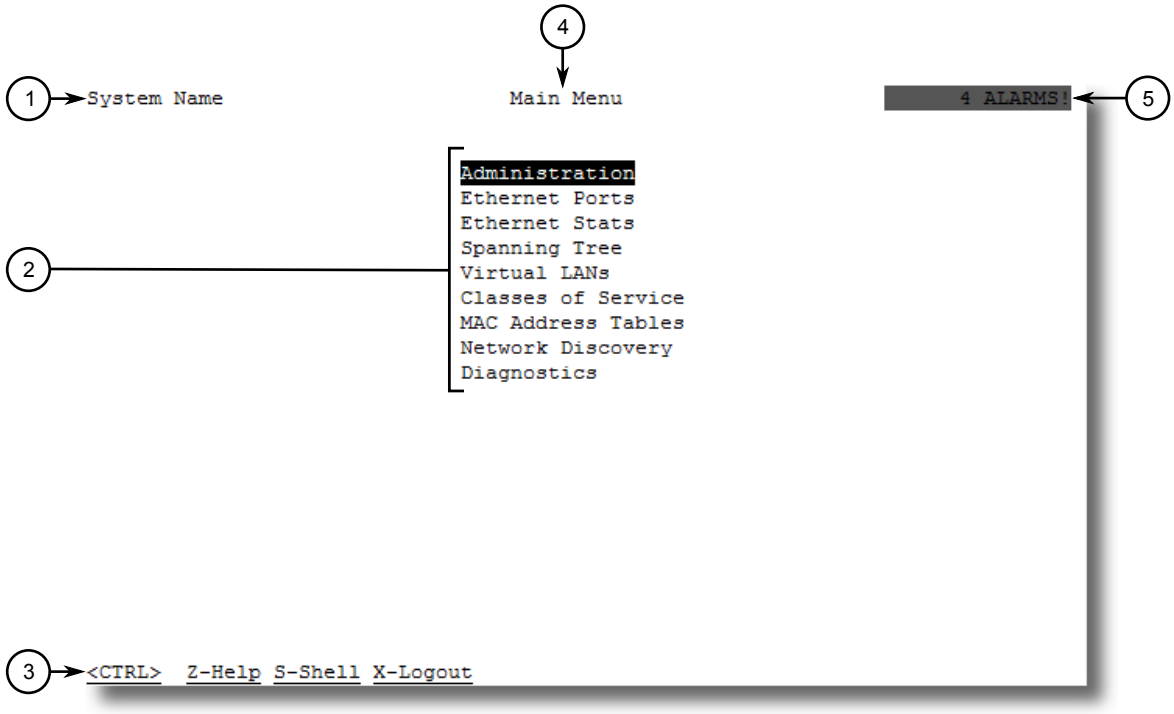


Figure 6: Console Interface (Example)

1. System Identification **2.** Menus **3.** Command Bar **4.** Menu Name **5.** Alarms Indicator

NOTE
The system identifier is user configurable. For more information about setting the system name, refer to *Section 4.1, "Configuring the System Information"* .

Navigating the Interface

Use the following controls to navigate between screens in the Console interface:

Enter	Select a menu item and press this **Enter** to enter the sub-menu or screen beneath.
Esc	Press **Esc** to return to the previous screen.

Configuring Parameters

Use the following controls to select and configure parameters in the Console interface:

Up/Down Arrow Keys	Use the up and down arrow keys to select parameters.
Enter	Select a parameter and press **Enter** to start editing a parameter. Press **Enter** again to commit the change.
Esc	When editing a parameter, press **Esc** to abort all changes.

Commands

The command bar lists the various commands that can be issued in the Console interface. Some commands are specific to select screens. The standard commands include the following:

Ctrl + A	Commits configuration changes made on the current screen. **NOTE** *Before exiting a screen, RUGGEDCOM ROS will automatically prompt the user to save any changes that have not been committed.*
Ctrl + I	Inserts a new record.
Ctrl + L	Deletes a record.
Ctrl + S	Opens the CLI interface.
Ctrl + X	Terminates the current session. This command is only available from the main menu.
Ctrl + Z	Displays important information about the current screen or selected parameter.

Section 2.6

Using the Command Line Interface

The Command Line Interface (CLI) offers a series of powerful commands for updating RUGGEDCOM ROS, generating certificates/keys, tracing events, troubleshooting and much more. It is accessed via the Console interface by pressing **Ctrl-S**.

CONTENTS

Section 2.6.1

Available CLI Commands

The following commands are available at the command line:

Command	Description	Authorized Users
alarms `all`	Displays a list of available alarms. Optional and/or required parameters include: • `all` displays all available alarms	Guest, Operator, Admin
arp	Displays the IP to MAC address resolution table.	Admin
clearalarms	Clears all alarms.	Operator, Admin
clearethstats `[ all | port ]`	Clears Ethernet statistics for one or more ports. Optional and/or required parameters include: • `all` clears statistics for all ports	Operator, Admin

Command	Description	Authorized Users
	• *port* is a comma separated list of port numbers (e.g. 1,3-5,7)	
clearlogs	Clears the system and crash logs.	Admin
clrcblstats [all | *port*]	Clears cable diagnostics statistics for one or more ports. Optional and/or required parameters include: • all clears statistics for all ports • *port* is a comma separated list of port numbers (e.g. 1,3-5,7)	Admin
clrstpstats	Clears all spanning tree statistics.	Operator, Admin
cls	Clears the screen.	Guest, Operator, Admin
dir	Prints the directory listing.	Guest, Operator, Admin
exit	Terminates the session.	Guest, Operator, Admin
factory	Enables factory mode, which includes several factory-level commands used for testing and troubleshooting. Only available to admin users. **CAUTION!** *Misuse of the factory commands may corrupt the operational state of device and/or may permanently damage the ability to recover the device without manufacturer intervention.*	Admin
flashfiles { info *filename* | defrag }	A set of diagnostic commands to display information about the Flash filesystem and to defragment Flash memory. Optional and/or required parameters include: • info *filename* displays information about the specified file in the Flash file system • defrag defragments files in the Flash file system For more information about the **flashfiles** command, refer to Section 2.7, "Managing the Flash File System" .	Admin
flashleds *timeout*	Flashes the LED indicators on the device for a specified number of seconds. Optional and/or required parameters include: • *timeout* is the number of seconds to flash the LED indicators. To stop the LEDs from flashing, set the timeout period to 0 (zero).	Admin
fpgacmd	Provides access to the FPGA management tool for troubleshooting time synchronization.	Admin
help *command*	Displays a brief description of the specified command. If no command is specified, it displays a list of all available commands, including a description for each. Optional and/or required parameters include: • *command* is the command name.	Guest, Operator, Admin
ipconfig	Displays the current IP address, subnet mask and default gateway. This command provides the only way of determining these values when DHCP is used.	Guest, Operator, Admin
loaddflts	Loads the factory default configuration.	Admin
logout	Logs out of the shell.	Guest, Operator, Admin
logs	Displays syslog entries in CLI shell.	Admin

Command	Description	Authorized Users
ping *address* { *count* | *timeout* }	Sends an ICMP echo request to a remotely connected device. For each reply received, the round trip time is displayed. Use this command to verify connectivity to the next connected device. It is a useful tool for testing commissioned links. This command also includes the ability to send a specific number of pings with a specified time for which to wait for a response. Optional and/or required parameters include: • *address* is the target IP address. • *count* is the number of echo requests to send. The default is 4. • *timeout* is the time in milliseconds to wait for each reply. The range is 2 to 5000 seconds. The default is 300 milliseconds. **NOTE** *The device to be pinged must support ICMP echo. Upon commencing the ping, an ARP request for the MAC address of the device is issued. If the device to be pinged is not on the same network as the device pinging the other device, the default gateway must be programmed.*	Guest, Operator, Admin
purgemac	Purges the MAC Address table.	Operator, Admin
random	Display seeds or random numbers.	Admin
reset	Perform a hard reset of the switch.	Operator, Admin
resetport { all | *ports* }	Resets one or more Ethernet ports, which may be useful for forcing re-negotiation of speed and duplex, or in situations where the link partner has latched into an inappropriate state. Optional and/or required parameters include: • all resets all ports • *ports* is a comma separated list of port numbers (e.g. 1,3-5,7)	Operator, Admin
rmon	Displays the names of all RMON alarm eligible objects.	Guest, Operator, Admin
route	Displays the gateway configuration.	Guest, Operator, Admin
sfp *port* { base | alarms | diag | calibr | thr | all | no parameter specified }	Displays SFP (Small Form Factor Pluggable) device information and diagnostics. If optional or required parameters are not used, this command displays the base and extended information. Optional and/or required parameters include: • *port* is the port number for which the data are required • base displays the base information • alarms displays alarms and warning flags • diag displays measured data • calibr displays calibration data for external calibration • thr displays thresholds data • all displays all diagnostic data	Admin
sql { default | delete | help | info | insert | save | select | update }	Provides an SQL-like interface for manipulating all system configuration and status parameters. All commands, clauses, table, and column names are case insensitive. Optional and/or required parameters include: • default sets all records in a table(s) to factory defaults • delete allows for records to be deleted from a table • help provides a brief description for any SQL command or clause • info displays a variety of information about the tables in the database	Admin

Command	Description	Authorized Users
	• `insert` enables new records to be inserted into a table • `save` saves the database to non-volatile memory storage • `select` queries the dtabase and displays selected records • `update` enable existing records in a table to be updated For more information about the **`sql`** command, refer to Section 2.6.4, "Using SQL Commands" .	
`sshkeygen` *keytype* *N*	Generates new SSH keys in `ssh.keys`. Optional and/or required parameters include: • *keytype* is the type of key, either rsa or dsa • *N* is the number of bits in length. The allowable sizes are 1024, 2048 or 3072	Admin
`sshpubkey`	List, remove and update key entries in sshpub.keys file.	Admin
`sslkeygen` *keytype* *N*	Generates a new SSL certificate in `ssl.crt`. Optional and/or required parameters include: • *keytype* is the type of key, either rsa or ecc • *N* is the number of bits in length. For RSA keys, the allowable sizes are 1024, 2048 or 3072. For ECC keys, the allowable sizes are 192, 224, 256, 384, or 521.	Admin
`telnet` *dest*	Opens a telnet session. Press **Ctrl-C** to close the session. Optional and/or required parameters include: • *dest* is the server's IP address	Guest, Operator, Admin
`tftp` { *dest* | *cmd* | *fsource* | *fdest* }	Opens a TFTP session. Press **Ctrl-C** to close the session. Optional and/or required parameters include: • *dest* is the remote TFTP server's IP address • *cmd* is either **`put`** (upload) or **`get`** (download) • *fsource* is the source filename • *fdest* is the destination filename	Admin
`trace`	Starts event tracing. Run **`trace ?`** for more help.	Operator, Admin
`type` *filename*	Displays the contents of a text file. Optional and/or required parameters include: • *filename* is the name of the file to be read	Guest, Operator, Admin
`version`	Prints the software version.	Guest, Operator, Admin
`xmodem` { `send` | `receive` } *filename*	Opens an XModem session. Optional and/or required parameters include: • `send` sends the file to the client. • `receive` receives the file from the client. • *filename* is the name of the file to be read.	Operator, Admin

Section 2.6.2

Tracing Events

The CLI trace command provides a means to trace the operation of various protocols supported by the device. Trace provides detailed information, including STP packet decodes and MAC address displays.

NOTE
Tracing has been designed to provide detailed information to expert users. Note that all tracing is disabled upon device startup.

To trace an event, do the following:

1. Log in to the device as an admin user and access the CLI shell. For more information about accessing the CLI shell, refer to Section 2.6, "Using the Command Line Interface" .
2. Determine the protocols and associated options available by typing:

   ```
   trace ?
   ```

   If an option such as `allon` or `alloff` is required, determine which options are available for the desired protocol by typing:

   ```
   trace protocol ?
   ```

   NOTE
   If required, expand the trace scope by stringing protocols and their associated options together using a vertical bar (|).

3. Select the type of trace to run by typing:

   ```
   trace protocol option
   ```

   Where:

   - *protocol* is the protocol to trace
   - *option* is the option to use during the trace

   Example:

   ```
   >trace transport allon
                        TRANSPORT: Logging is enabled
   ```

4. Start the trace by typing:

   ```
   trace
   ```

Section 2.6.3

Executing Commands Remotely via RSH

The Remote Shell (RSH) facility can be used from a workstation to cause the product to act upon commands as if they were entered at the CLI prompt. The syntax of the RSH command is usually of the form:

```
rsh ipaddr -l auth_token command_string
```

Where:

- *ipaddr* is the address or resolved name of the device.
- *auth_token* is the user name (i.e. guest, operator or admin) and corresponding password separated by a comma. For example, *admin,secret*.
- *command_string* is the RUGGEDCOM ROS CLI command to execute.

NOTE
The access level (corresponding to the user name) selected must support the given command.

NOTE
Any output from the command will be returned to the workstation submitting the command. Commands that start interactive dialogs (such as **`trace`***) cannot be used.*

Section 2.6.4
Using SQL Commands

RUGGEDCOM ROS provides an *SQL-like* command facility that allows expert users to perform several operations not possible under the traditional Web or CLI interface. For instance:

- Restoring the contents of a specific table, but not the whole configuration, to their factory defaults.
- Search tables in the database for specific configurations.
- Make changes to tables predicated upon existing configurations.

When combined with RSH, SQL commands provide a means to query and configure large numbers of devices from a central location.

NOTE
For a list of parameters available under the **`sql`** *command, refer to* *Section 2.6.1, "Available CLI Commands"* .

NOTE
Read/write access to tables containing passwords or shared secrets is unavailable using SQL commands.

CONTENTS

Section 2.6.4.1
Finding the Correct Table

Many SQL commands operate upon specific tables in the database, and require the table name to be specified. Navigating the menu system in the console interface to the desired menu and pressing **Ctrl-Z** displays the name of the table. The menu name and the corresponding database table name will be cited.

Another way to find a table name is to type the following in the CLI:

```
sql info tables
```

This command also displays menu names and their corresponding database table names depending upon the features supported by the device. For example:

```
Table Description
--------------------------------------------------------------------------------
alarms Alarms
cpuDiags CPU Diagnostics
ethPortCfg Port Parameters
ethPortStats Ethernet Statistics
ethPortStatus Port Status
ipCfg IP Services
```

Section 2.6.4.2
Retrieving Information

The following describes various methods for retrieving information about tables and parameters.

» Retrieving Information from a Table

Use the following command to display a summary of the parameters within a table, as well as their values:

```
sql select from  table
```

Where:

- *table* is the name of the table

Example:

```
>sql select from ipAddrtable

IP Address      Subnet          IfIndex    IfStats    IfTime     IfName
172.30.146.88   255.255.224.0   1001       17007888   2994       vlan1

1 records selected
```

» Retrieving Information About a Parameter from a Table

Use the following command to retrieve information about a specific parameter from a table:

NOTE
The parameter name must be the same as it is displayed in the menu system, unless the name contains spaces (e.g. ip address). Spaces must be replaced with underscores (e.g. ip_address) or the parameter name must be wrapped in double quotes (e.g. "ip address").

```
sql select  parameter  from  table
```

Where:

- *parameter* is the name of the parameter
- *table* is the name of the table

Example:

```
>sql select "ip address" from ipSwitchIfCfg

IP Address
192.168.0.1
```

```
1 records selected
```

» Retrieving Information from a Table Using the *Where* Clause

Use the following command to display specific parameters from a table that have a specific value:

```
sql select from table where parameter = value
```

Where:

- *table* is the name of the table
- *parameter* is the name of the parameter
- *value* is the value of the parameter

Example:

```
>sql select from ethportcfg where media = 1000T

Port Name            ifName          Media       State    AutoN Speed Dupx  FlowCtrl LFI Alarm
1  Port 1          1             1000T       Enabled  On    Auto  Auto  Off      Off On
2  Port 2          2             1000T       Enabled  On    Auto  Auto  Off      Off On
3  Port 3          3             1000T       Enabled  On    Auto  Auto  Off      Off On
4  Port 4          4             1000T       Enabled  On    Auto  Auto  Off      Off On

4 records selected
```

Further refine the results by using `and` or `or` operators:

```
sql select from table where parameter = value [ { and | or } | parameter | = | value ...]
```

Where:

- *table* is the name of the table
- *parameter* is the name of the parameter
- *value* is the value of the parameter

Example:

```
>sql select from ethportcfg where media = 1000T and State = enabled

Port Name            ifName          Media       State    AutoN Speed Dupx  FlowCtrl LFI Alarm
1  Port 1          1             1000T       Enabled  On    Auto  Auto  Off      Off on
2  Port 2          2             1000T       Enabled  On    Auto  Auto  Off      Off On
3  Port 3          3             1000T       Enabled  On    Auto  Auto  Off      Off On
4  Port 4          4             1000T       Enabled  On    Auto  Auto  Off      Off On

4 records selected
```

Section 2.6.4.3

Changing Values in a Table

Use the following command to change the value of parameters in a table:

```
sql update table set parameter = value
```

Where:

- *table* is the name of the table

- *parameter* is the name of the parameter
- *value* is the value of the parameter

Example:

```
>sql update iplcfg set IP_Address_Type = static
1 records updated
```

Conditions can also be included in the command to apply changes only to parameters that meet specific criteria. In the following example, flow control is enabled on ports that are operating in 100 Mbps full-duplex mode with flow control disabled:

```
>sql update ethportcfg set FlowCtrl = Off where ( Media = 100TX and FlowCtrl = On )
2 records updated
```

Section 2.6.4.4
Resetting a Table

Use the following command to reset a table back to its factory defaults:

```
sql default into  table
```

Where:

- *table* is the name of the table

Section 2.6.4.5
Using RSH and SQL

The combination of remote shell scripting and SQL commands offers a means to interrogate and maintain a large number of devices. Consistency of configuration across sites may be verified by this method. The following presents a simple example where the devices to interrogate are drawn from the file `Devices`:

```
C:> type Devices
10.0.1.1
10.0.1.2

C:\> for /F %i in (devices) do rsh %i -l admin,admin sql select from ipAddrtable

C:\>rsh 10.0.1.1 -l admin,admin sql select from ipAddrtable

IP Address      Subnet          IfIndex    IfStats    IfTime     IfName
192.168.0.31    255.255.255.0   1001       274409096  2218       vlan1

1 records selected

C:\>rsh 10.0.1.2 -l admin,admin sql select from ipAddrtable
0 records selected
C:\
```

Section 2.7
Managing the Flash File System

This section describes how to manage the file system.

CONTENTS

Section 2.7.1
Viewing a List of Flash Files

To view a list of files currently stored in Flash memory, do the following:

1. Log in to the device as an admin user and access the CLI shell. For more information about accessing the CLI shell, refer to Section 2.6, "Using the Command Line Interface" .
2. Type **`flashfiles`**. A list of files currently in Flash memory is displayed, along with their locations and the amount of memory they consume. For example:

```
>flashfiles
------------------------------------------------------------------
Filename             Base    Size  Sectors     Used
------------------------------------------------------------------
boot.bin         00000000 110000    0-16   1095790
main.bin         00110000 140000   17-36   1258403
fpga.xsvf        00250000 010000   37-37     55882
syslog.txt       00260000 140000   38-57     19222
ssh.keys         003A0000 010000   58-58       915
ssl.crt          003B0000 010000   59-59      1970
banner.txt       003C0000 010000   60-60       256
crashlog.txt     003D0000 010000   61-61       256
config.bak       003E0000 010000   62-62     15529
config.csv       003F0000 008000   63-63     15529
factory.txt      003FC000 004000   66-66       407
------------------------------------------------------------------
```

Section 2.7.2
Viewing Flash File Details

To view the details of a file currently stored in Flash memory, do the following:

1. Log in to the device as an admin user and access the CLI shell. For more information about accessing the CLI shell, refer to Section 2.6, "Using the Command Line Interface" .
2. Display information about a file by typing:

```
flashfiles info  filename
```

Where:

- *`filename`* is the name of the file stored in Flash memory

Details, similar to the following, are displayed.

```
>flashfiles info main.bin

Flash file information for main.bin:
Header version   : 4

Platform         : ROS-MPC83
File name        : main.bin
Firmware version : v5.0.0
Build date       : Sep 27 2014 15:50
File length      : 2624659
Board IDs        :  3d
Header CRC       : 73b4
Header CRC Calc  : 73b4
Body CRC         : b441
Body CRC Calc    : b441
```

Section 2.7.3

Defragmenting the Flash File System

The flash memory is defragmented automatically whenever there is not enough memory available for a binary upgrade. However, fragmentation can occur whenever a new file is uploaded to the unit. Fragmentation causes sectors of available memory to become separated by ones allocated to files. In some cases, the total available memory might be sufficient for a binary upgrade, but that memory may not be available in one contiguous region.

To defragment the flash memory, do the following:

1. Log in to the device as an admin user and access the CLI shell. For more information about accessing the CLI shell, refer to Section 2.6, "Using the Command Line Interface" .
2. Defragment the flash memory by typing:

```
flashfiles defrag
```

Section 2.8

Accessing BIST Mode

BIST (Built-In-Self-Test) mode is used by service technicians to test and configure internal functions of the device. It should only be accessed for troubleshooting purposes.

CAUTION!
Mechanical hazard – risk of damage to the device. Excessive use of BIST functions may cause increase wear on the device, which may void the warranty. Avoid using BIST functions unless instructed by a Siemens Customer Support representative.

To access BIST mode, do the following:

IMPORTANT!
Do not connect the device to the network when it is in BIST mode. The device will generate excess multicast traffic in this mode.

1. Disconnect the device from the network.

2. Connect to RUGGEDCOM ROS through the RS-232 console connection and a terminal application. For more information, refer to Section 2.1.1, "Connecting Directly" .
3. Reset the device. For more information, refer to Section 3.11, "Resetting the Device" .
4. During the boot up sequence, press **Ctrl-C** when prompted. The command prompt for BIST appears.

```
>
```

5. Type **`help`** to view a list of all available options under BIST.

Section 2.9

Accessing the Boot Loader

RUGGEDCOM ROS uses Uboot to control the boot up sequence of the device. Uboot is a feature-rich and widely used open source boot loader developed by DENX [http://www.denx.de/wiki/U-Boot].

NOTE
Access to the boot loader is disabled at the factory by default. All console inputs are ignored and users are directed automatically to the RUGGEDCOM ROS user interface.

Enabling the Boot Loader

To first enable access to the boot loader, do the following:

1. Using a PC/laptop, create a file named `bootoption.txt` and include the following line in the file:

```
Security=no
```

2. Upload the file to the device and reboot the device.

NOTE
Access to BIST and the boot loader can be later revoked by changing `no` *to* `yes`.

Accessing the Boot Loader

To access the boot loader, do the following:

1. Connect to RUGGEDCOM ROS through the RS-232 console connection and a terminal application. For more information, refer to Section 2.1.1, "Connecting Directly" .
2. Reset the device. For more information, refer to Section 3.11, "Resetting the Device" .
3. As soon as the device starts to boot up, press **Ctrl-Z**. The command prompt for Uboot appears.

```
=>
```

4. Type **`help`** to view a list of all available options under Uboot.

3 Device Management

This chapter describes how to configure and manage the device and its components, such as module interfaces, logs and files.

NOTE
For information about how to configure the device to work with a network, refer to Chapter 5, Setup and Configuration .

CONTENTS

Section 3.1
Viewing Product Information

During troubleshooting or when ordering new devices, Siemens personnel may request specific information about the device, such as the model, order code or serial number.

To view information about the device, navigate to ***Diagnostics » View Product Information***. The **Product Information** form appears.

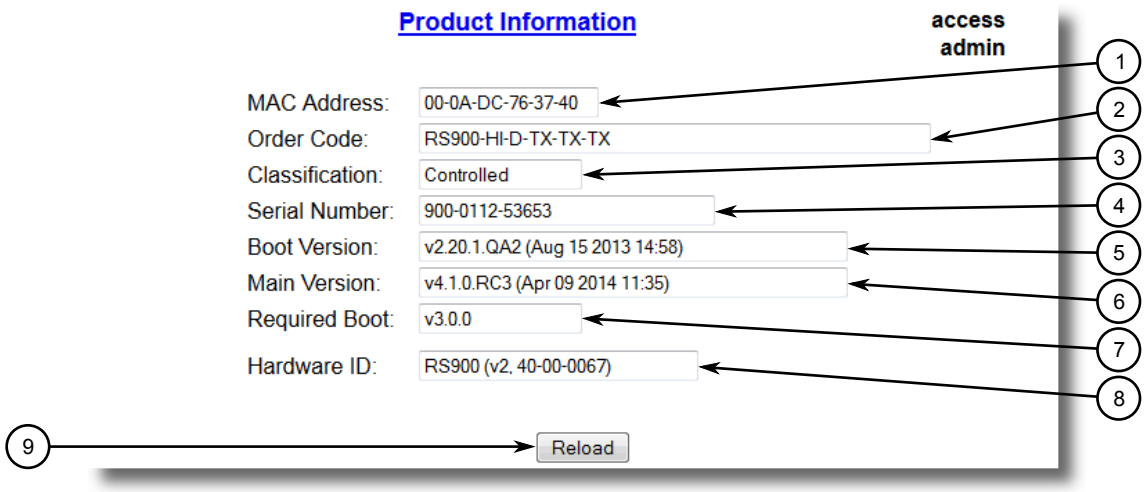


Figure 7: Product Information Form (Example)

1. MAC Address Box **2.** Order Code Box **3.** Classification Box **4.** Serial Number Box **5.** Boot Version Box **6.** Main Version Box **7.** Required Boot Box **8.** Hardware ID Box **9.** Reload Button

This screen displays the following information:

Parameter	Description
MAC Address	**Synopsis:** ##-##-##-##-##-## where ## ranges 0 to FF Shows the unique MAC address of the device.
Order Code	**Synopsis:** Any 57 characters Shows the order code of the device.
Classification	**Synopsis:** Any 15 characters Provides system classification. The value *Controlled* indicates the main firmware is a Controlled release. The value *Non-Controlled* indicates the main firmware is a Non-Controlled release. The *Controlled* main firmware can run on Controlled units, but it can not run on Non-Controlled units. The *Non-Controlled* main firmware can run on both Controlled and Non-Controlled units.
Serial Number	**Synopsis:** Any 31 characters Shows the serial number of the device.
Boot Version	**Synopsis:** Any 47 characters Shows the version and the build date of the boot loader software.
Main Version	**Synopsis:** Any 47 characters Shows the version and build date of the main operating system software.
Required Boot	**Synopsis:** Any 15 characters Shows the minimum boot software loader version required by running main.
Hardware ID	**Synopsis:** { RSMCPU (40-00-0008 Rev B1), RSMCPU2 (40-00-0026 Rev A1), RS400 (40-00-0010 Rev B2), RMC30, RS900 (40-00-0025 Rev B1), RS900 (40-00-0032 Rev B1), RS1600M, RS400 (40-00-0010 Rev C1), RSG2100, RS900G, RSG2200, RS969, RS900 (v2, 40-00-0066), RS900 (v2, 40-00-0067), , RS416 (40-00-0078), RMC30 (v2), RS930 (40-00-0089), RS969 (v2, 40-00-0090), RS910 (40-00-0091-001 Rev A), RS920L (40-00-0102-001 Rev A), RS940G (40-00-0097-000 Rev A), RSi80X series CPU board, RSG2300, RS416v2, ... }

Parameter	Description
	Shows the type, part number, and revision level of the hardware.

Section 3.2

Viewing CPU Diagnostics

To view CPU diagnostic information useful for troubleshooting hardware and software performance, navigate to ***Diagnostics » View CPU Diagnostics***. The **CPU Diagnostics** form appears.

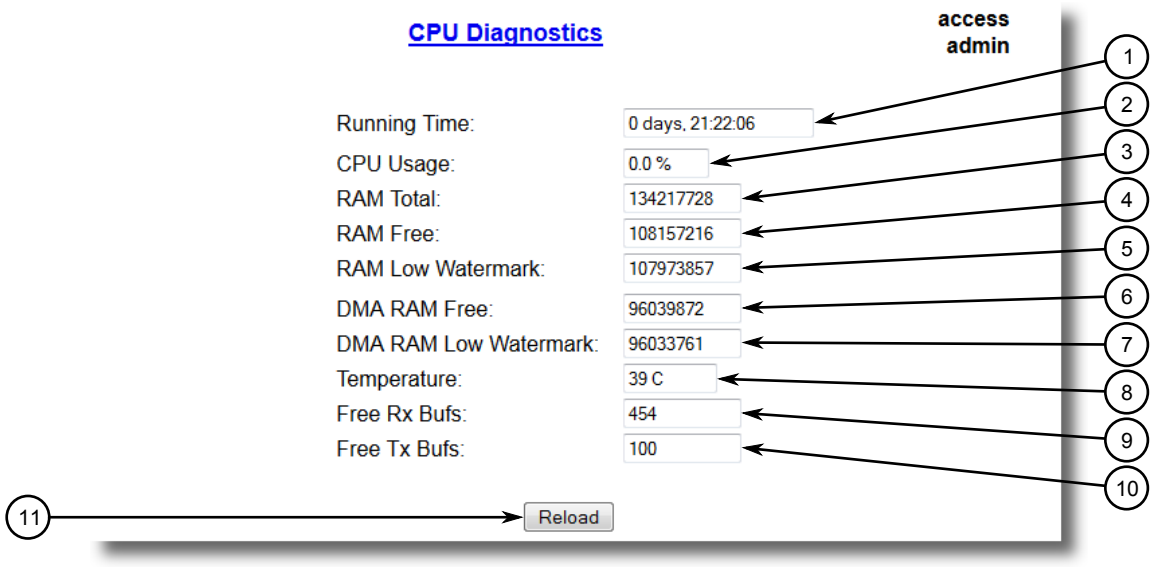


Figure 8: CPU Diagnostics Form

1. Running Time Box **2.** CPU Usage Box **3.** RAM Total Box **4.** RAM Free Box **5.** RAM Low Watermark Box **6.** DMA RAM Free Box **7.** DMA RAM Low Watermark Box **8.** Temperature Box **9.** Free Rx Bufs Box **10.** Free Tx Bufs Box **11.** Reload Button

This screen displays the following information:

Parameter	Description
Running Time	**Synopsis:** DDDD days, HH:MM:SS The amount of time since the device was last powered on.
Total Powered time	**Synopsis:** DDDD days, HH:MM:SS The cumulative powered up time of the device.
CPU Usage	**Synopsis:** 0.0 to 100.0% The percentage of available CPU cycles used for device operation as measured over the last second.
RAM Total	**Synopsis:** 0 to 4294967295 The total size of RAM in the system.
RAM Free	**Synopsis:** 0 to 4294967295 The total size of RAM still available.

Parameter	Description
RAM Low Watermark	**Synopsis:** 0 to 4294967295 The size of RAM that have never been used during the system runtime.
Temperature	**Synopsis:** -32768 to 32767 C The temperature on CPU board.
Free Rx Bufs	**Synopsis:** 0 to 4294967295 Free Rx Buffers.
Free Tx Bufs	**Synopsis:** 0 to 4294967295 Free Tx Buffers.

Section 3.3

Restoring Factory Defaults

The device can be completely or partially restored to its original factory default settings. Excluding groups of parameters from the factory reset, such as those that affect basic connectivity and SNMP management, is useful when communication with the device is still required during the reset.

The following categories are not affected by a selective configuration reset:

- IP Interfaces
- IP Gateways
- SNMP Users
- SNMP Security to Group Maps
- SNMP Access

In addition, the following categories are not affected by a full or selective configuration reset:

- Time Zone
- DST Offset
- DST Rule

To restore factory defaults, do the following:

1. Navigate to ***Diagnostics » Load Factory Defaults***. The **Load Factory Defaults** form appears.

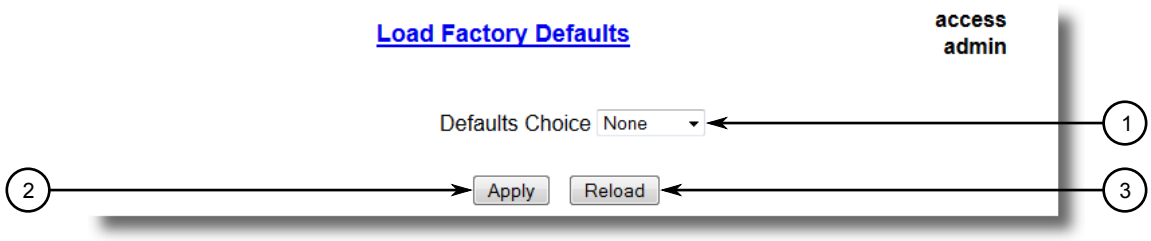


Figure 9: Load Factory Defaults Form

1. Defaults Choice List **2.** Apply Button **3.** Reload

2. Configure the following parameter(s) as required:

Parameter	Description
Defaults Choice	**Synopsis:** { None, Selected, All } Setting some records like IP Interfaces management interface, default gateway, SNMP settings to default value would cause switch not to be accessible with management applications. This parameter allows user to choose to load defaults to Selected tables, which would preserve configuration for tables that are critical for switch management applications, or to force All tables to default settings.

3. Click **Apply**.

Section 3.4

Managing SSH and SSL Keys and Certificates

RUGGEDCOM ROS uses X.509v3 certificates and keys to establish secure connections for remote logins (SSH) and Web access (SSL).

IMPORTANT!
Siemens recommends the following actions before commissioning the device:

- *Replace the factory-provisioned SSL certificate with one signed by a trusted Certificate Authority (CA)*
- *Replace the factory-provisioned SSH host key pair with one generated by a trusted security authority*

NOTE
Only admin users can write certificates and keys to the device.

Each RUGGEDCOM ROS device is shipped with a unique RSA 2048-based SSH host key pair and an RSA 2048-based self-signed certificate that are generated at and provisioned by the factory. The administrator may upload a new certificate and keys to the system at any time, which will overwrite the existing ones. In addition, CLI commands are available to regenerate SSL certificate and key pair as well as the SSH host key pair.

There are three types of certificates and keys used in RUGGEDCOM ROS:

NOTE
Network exposure to a ROS unit operating with the default keys, although always only temporary by design, should be avoided. The best way to reduce or eliminate this exposure is to provision user-created certificate and keys as quickly as possible, and preferably before the unit is placed in network service.

NOTE
The default certificate and keys are common to all RUGGEDCOM ROS versions without a certificate or key files. That is why it is important to either allow the key auto-generation to complete or to provision custom keys. In this way, one has at least unique, and at best, traceable and verifiable keys installed when establishing secure communication with the unit.

- **Default**
  A default certificate and SSL/SSH keys are built in to RUGGEDCOM ROS and are common across all RUGGEDCOM ROS units sharing the same firmware image. In the event that valid SSL certificate or SSL/SSH key files are not available on the device (as is usually only the case when upgrading from an old ROS version that does not support user-configurable keys and therefore does was not shipped with unique, factory-generated keys), the

default certificate and keys are put into service *temporarily* so that SSH and SSL (HTTPS) sessions can be served until generated or provisioned keys are available.

- **Auto-Generated**
  If a default SSL certificate and SSL/SSH keys are in use, RUGGEDCOM ROS immediately begins to generate a unique certificate and SSL/SSH keys for the device in the background. If a custom certificate and keys are loaded while auto-generated certificates and keys are being generated, the generator will abort and the custom certificate and keys and will be used.
- **Custom (Recommended)**
  Custom certificates and keys are the most secure option. They give the user complete control over certificate and key management, allow for the provision of certificates signed by a public or local certificate authority, enable strictly controlled access to private keys, and allow authoritative distribution of SSL certificates, any CA certificates, and public SSH keys.

NOTE
The RSA or EC private key corresponding to the SSL certificate must be appended to the certificate in the `ssl.crt` *file.*

CONTENTS

Section 3.4.1

SSL Certificates

RUGGEDCOM ROS supports SSL certificates that conform to the following specifications:

- X.509 v3 digital certificate format
- PEM format
- For RUGGEDCOM ROS Controlled verions: RSA key pair, 1024, 2048 or 3072 bits; or EC 256, 384 or 521 bits
- For RUGGEDCOM ROS Non-Controlled (NC) verions: RSA key pair, 512 to 2048 bits

NOTE
RSA keys smaller than 2048 bits in length are not recommended. Support is only included here for compatibility with legacy equipment.

The following (bash) shell script fragment uses the `openssl` command line utility to generate a self-signed X.509 v3 SSL certificate with a 2048 bit RSA key suitable for use in RUGGEDCOM ROS. Note that two standard PEM files are required: the SSL certificate and the RSA private key file. These are concatenated into the resulting `ssl.crt` file, which may then be uploaded to RUGGEDCOM ROS:

```
# RSA key size:
BITS=2048
# 20 years validity:
DAYS=7305

# Values that will be stored in the Distinguished Name fields:

COUNTRY_NAME=CA                    # Two-letter country code
```

```
STATE_OR_PROVINCE_NAME=Ontario     # State or Province
LOCALITY_NAME=Concord              # City
ORGANIZATION=Ruggedcom.com         # Your organization's name
ORGANIZATION_CA=${ORGANIZATION}_CA # Your Certificate Authority
COMMON_NAME=RC                     # The DNS or IP address of the ROS unit
ORGANIZATIONAL_UNIT=ROS            # Organizational unit name

# Variables used in the construction of the certificate
REQ_SUBJ="/C=${COUNTRY_NAME}/ST=${STATE_OR_PROVINCE_NAME}/L=${LOCALITY_NAME}/O=${ORGANIZATION}/OU=
${ORGANIZATIONAL_UNIT}/CN=${COMMON_NAME}/"
REQ_SUBJ_CA="/C=${COUNTRY_NAME}/ST=${STATE_OR_PROVINCE_NAME}/L=${LOCALITY_NAME}/O=${ORGANIZATION_CA}/
OU=${ORGANIZATIONAL_UNIT}/"

#########################################################################
# Make the self-signed SSL certificate and RSA key pair:

openssl req -x509 -newkey rsa:${BITS} -nodes \
 -days ${DAYS} -subj ${REQ_SUBJ} \
 -keyout ros_ssl.key  \
 -out    ros_ssl.crt

# Concatenate Cert and Key into a single file suitable for upload to ROS:
# Note that cert must precede the RSA key:
cat  ros_ssl.crt  ros_ssl.key > ssl.crt
```

The following is an example of a self-signed SSL certificate generated by RUGGEDCOM ROS:

```
Certificate:
    Data:
        Version: 3 (0x2)
        Serial Number:
            ca:01:2d:c0:bf:f9:fd:f2
        Signature Algorithm: sha1WithRSAEncryption
        Issuer: C=CA, ST=Ontario, L=Concord, O=RuggedCom.com, OU=RC, CN=ROS
        Validity
            Not Before: Dec  6 00:00:00 2012 GMT
            Not After : Dec  7 00:00:00 2037 GMT
        Subject: C=CA, ST=Ontario, L=Concord, O=RuggedCom.com, OU=RC, CN=ROS
        Subject Public Key Info:
            Public Key Algorithm: rsaEncryption
            RSA Public Key: (1024 bit)
                Modulus (1024 bit):
                    00:83:e8:1f:02:6b:cd:34:1f:01:6d:3e:b6:d3:45:
                    b0:18:0a:17:ae:3d:b0:e9:c6:f2:0c:af:b1:3e:e7:
                    fd:f2:0e:75:8d:6a:49:ce:47:1d:70:e1:6b:1b:e2:
                    fa:5a:1b:10:ea:cc:51:41:aa:4e:85:7c:01:ea:c3:
                    1e:9e:98:2a:a9:62:48:d5:27:1e:d3:18:cc:27:7e:
                    a0:94:29:db:02:5a:e4:03:51:16:03:3a:be:57:7d:
                    3b:d1:75:47:84:af:b9:81:43:ab:90:fd:6d:08:d3:
                    e8:5b:80:c5:ca:29:d8:45:58:5f:e4:a3:ed:9f:67:
                    44:0f:1a:41:c9:d7:62:7f:3f
                Exponent: 65537 (0x10001)
        X509v3 extensions:
            X509v3 Subject Key Identifier:
                EC:F3:09:E8:78:92:D6:41:5F:79:4D:4B:7A:73:AD:FD:8D:12:77:88
            X509v3 Authority Key Identifier:
                keyid:EC:F3:09:E8:78:92:D6:41:5F:79:4D:4B:7A:73:AD:FD:8D:12:77:88
                DirName:/C=CA/ST=Ontario/L=Concord/O=RuggedCom.com/OU=RC/CN=ROS
                serial:CA:01:2D:C0:BF:F9:FD:F2
            X509v3 Basic Constraints:
                CA:TRUE
    Signature Algorithm: sha1WithRSAEncryption
        64:cf:68:6e:9f:19:63:0e:70:49:a6:b2:fd:09:15:6f:96:1d:
        4a:7a:52:c3:46:51:06:83:7f:02:8e:42:b2:dd:21:d2:e9:07:
        5c:c4:4c:ca:c5:a9:10:49:ba:d4:28:fd:fc:9d:a9:0b:3f:a7:
        84:81:37:ca:57:aa:0c:18:3f:c1:b2:45:2a:ed:ad:dd:7f:ad:
        00:04:76:1c:f8:d9:c9:5c:67:9e:dd:0e:4f:e5:e3:21:8b:0b:
```

```
        37:39:8b:01:aa:ca:30:0c:f1:1e:55:7c:9c:1b:43:ae:4f:cd:
        e4:69:78:25:5a:a5:f8:98:49:33:39:e3:15:79:44:37:52:da:
        28:dd
```

Section 3.4.2

SSH Host Key

NOTE
SSH is not supported in Non-Controlled (NC) versions of RUGGEDCOM ROS.

Controlled versions of RUGGEDCOM ROS support SSH public/private key pairs that conform to the following specifications:

- PEM format
- DSA key pair, 1024, 2048 or 3072 bits in length
- RSA key pair, 1024, 2048 or 3072 bits in length

NOTE
DSA or RSA key generation times increase depending on the key length. 1024 bit RSA keys take less than 5 minutes to generate on a lightly loaded unit, whereas 2048 bit keys may take significantly longer. A typical modern PC system, however, can generate these keys in seconds.

The following (bash) shell script fragment uses the `ssh-keygen` command line utility to generate a 2048 bit RSA key suitable for use in RUGGEDCOM ROS. The resulting `ssh.keys` file may then be uploaded to RUGGEDCOM ROS:

```
# RSA key size:
BITS=2048

# Make an SSH key pair:
ssh-keygen -t RSA -b $BITS -N '' -f ssh.keys
```

The following is an example of an SSH key generated by RUGGEDCOM ROS:

```
Private-Key: (1024 bit)
priv:
    00:b2:d3:9d:fa:56:99:a5:7a:ba:1e:91:c5:e1:35:
    77:85:e8:c5:28:36
pub:
    6f:f3:9e:af:e6:d6:fd:51:51:b9:fa:d5:f9:0a:b7:
    ef:fc:d7:7c:14:59:52:48:52:a6:55:65:b7:cb:38:
    2e:84:76:a3:83:62:d0:83:c5:14:b2:6d:7f:cc:f4:
    b0:61:0d:12:6d:0f:5a:38:02:67:a4:b7:36:1d:49:
    0a:d2:58:e2:ff:4a:0a:54:8e:f2:f4:c3:1c:e0:1f:
    9b:1a:ee:16:e0:e9:eb:c8:fe:e8:16:99:e9:61:81:
    ed:e4:f2:58:fb:3b:cb:c3:f5:9a:fa:ed:cd:39:51:
    47:90:5d:6d:1b:27:d5:04:c5:de:57:7e:a7:a3:03:
    e8:fb:0a:d5:32:89:40:12
P:
    00:f4:81:c1:9b:5f:1f:eb:ac:43:2e:db:dd:77:51:
    6e:1c:62:8d:4e:95:c6:e7:b9:4c:fb:39:9c:9d:da:
    60:4b:0f:1f:c6:61:b0:fc:5f:94:e7:45:c3:2b:68:
    9d:11:ba:e1:8a:f9:c8:6a:40:95:b9:93:7c:d0:99:
    96:bf:05:2e:aa:f5:4e:f0:63:02:00:c7:c2:52:c7:
    1a:70:7c:f7:e5:fe:dd:3d:57:02:86:ae:d4:89:20:
    ca:4b:46:80:ea:de:a1:30:11:5c:91:e2:40:d4:a3:
    82:c5:40:3b:25:8e:d8:b2:85:cc:f5:9f:a9:1d:ea:
```

```
    0a:ac:77:95:ee:d6:f7:61:e3
Q:
    00:d5:db:48:18:bd:ec:69:99:eb:ff:5f:e1:40:af:
    20:80:6d:5c:b1:23
G:
    01:f9:a1:91:c0:82:12:74:49:8a:d5:13:88:21:3e:
    32:ea:f1:74:55:2b:de:61:6c:fd:dd:f5:e1:c5:03:
    68:b4:ad:40:48:58:62:6c:79:75:b1:5d:42:e6:a9:
    97:86:37:d8:1e:e5:65:09:28:86:2e:6a:d5:3d:62:
    50:06:b8:d3:f9:d4:9c:9c:75:84:5b:db:96:46:13:
    f0:32:f0:c5:cb:83:01:a8:ae:d1:5a:ac:68:fb:49:
    f9:b6:8b:d9:d6:0d:a7:de:ad:16:2b:23:ff:8e:f9:
    3c:41:16:04:66:cf:e8:64:9e:e6:42:9a:d5:97:60:
    c2:e8:9e:f4:bc:8f:6f:e0
```

Section 3.4.3

Managing SSH Public Keys

RUGGEDCOM ROS allows admin users to list, add and delete SSH public keys. Public keys are added as non-volatile storage (i.e. flash) files on RUGGEDCOM ROS devices, and are retrieved at the time of SSH client authentication.

CONTENTS

Section 3.4.3.1

Public Key Requirements

Public keys are stored in a flash file, called *sshpub.keys*. The *sshpub.keys* file consists of ssh user public key entries. Similar to the config.csv file, each entry must be separated by an empty line. An entry has two components. They are, in sequence:

- Header
- Key

The header contains the parameters of the entry, separated by comma. The parameters are, in sequence:

- ID: A number between 0 and 9999
- Entry type: UserKey
- Access Level: (Admin, Operator or Guest)
- Revocation Status: active/inactive (always active for keys)
- User Name: This is the client's user name (not the RUGGEDCOM ROS user name). This will be used by clients to later SSH into the RUGGEDCOM ROS device.

The key must be in RFC4716 format, or in PEM format with any of the following header and footer lines:

```
-----BEGIN PUBLIC KEY-----
-----END PUBLIC KEY-----
```

```
-----BEGIN SSH2 PUBLIC KEY-----
-----END SSH2 PUBLIC KEY-----

-----BEGIN RSA PUBLIC KEY-----
-----END RSA PUBLIC KEY-----
```

The following is an example of a valid entry in the *sshpub.keys* file in PEM format:

```
1,userkey,admin,active,alice
---- BEGIN SSH2 PUBLIC KEY ----
AAAAB3NzaC1yc2EAAAABIwAAAQEA4mRrqfk+RKXnmGRvzMyWVDsbq5VwpGGrlLQYCrjVEa
NdbXsphqYKop8V5VUeXFRAUFzOy82yk8TF/5JxGPWq6wRNjhnYR7IY2AiMBq0+K8XeURl/
z5K2XNRjnqTZSFwkhaUVJeduvjGgOlNN4yvgUwF3n0idU9k3E1q/na+LmYIeGhOwzCqoAc
ipHAdR4fhD5u0jbmvjv+gDikTSZIbj9eFJfP09ekImMLHwbBry0SSBpqAKbwVdWEXIKQ47
zz7ao2/rs3rSV16IXSq3Qe8VZh2irah0Md6JFMOX2qm9fo1I62q1DDgheCOsOiGPf4xerH
rI2cs6FT31rAdx2JOjvw==
---- END SSH2 PUBLIC KEY ----
```

The following is an example of a valid entry in the *sshpub.keys* file in in RFC4716 format:

```
2,userkey,admin,active,bob
ssh-rsa AAAAB3NzaC1yc2EAAAADAQABAAABAQDH0NivR8zzbTxlecvFPzR/
GR24NrRJa0Lc7scNsWRgi0XulHuGrRLRB5RoQ39+spdig88Y8CqhRI49XJx7uLJe0Su3RvyNYz1jkdSwHq2hSZCpukJxJ6CK95Po/
sVa5Gq2gMaHowiYDSkcx+AJywzK/eM6i/jc125lRxFPdfkj74u+ob3PCvmIWz5z3WAJBrQU1IDPHDets511WMu8O9/
mAPZRwjqrWhRsqmcXZuv5oo54wIopCAZSo20SPzM2VmXFuUsEwDkvYMXLJK1koJPbDjH7yFFC7mwK2eMU/
oMFFn934cbO5N6etsJSvplYQ4pMCw6Ok8Q/bB5cPSOa/rAt bob@work
```

RUGGEDCOM ROS allows only 16 user key entries to be stored. Each key entry must meet the following limits:

- Key type must be either RSA 2048 bits or RSA 3072 bits
- Key size must not exceed 4000 base64 encoded characters
- Entry Type in the header must not exceed 8 ASCII characters
- Access Level in the header must not exceed 8 ASCII characters (*operator* is maximum)
- Revocation status in the header must not exceed 8 ASCII characters (*inactive* is maximum)
- User Name must not exceed 12 ASCII characters

Section 3.4.3.2
Adding a Public Key

Administrators can add one or more public keys to RUGGEDCOM ROS.

There are two ways to update *sshpub.keys*:

- Upload a locally-created file directly to the *sshpub.keys* file. The content of the file replace the content currently stored in flash memory.
- Upload a locally-created file to the *sshaddpub.keys* file. The content of the file is appended to the existing entries in the *sshpub.keys* file.

IMPORTANT!
*The content of the **sshaddpub.keys** file must follow the same syntax as the **sshpub.keys** file.*

To add keys, do the following:

1. Create a public key file via a host computer.

2. Transfer the public key file to the device using SFTP or Xmodem. For more information about transferring files, refer to Section 3.5, "Uploading/Downloading Files" .
3. Log in to the device as an admin user and access the CLI shell. For more information about accessing the CLI shell, refer to Section 2.6, "Using the Command Line Interface" .
4. Check the system log to make sure the files were properly transferred. For more information about viewing the system log, refer to Section 3.6.1, "Viewing Local and System Logs" .

Section 3.4.3.3
Viewing a List of Public Keys

Admin users can view a list of existing public keys on the device.

To view public keys, do the following:

1. Log in to the device as an admin user and access the CLI shell. For more information about accessing the CLI shell, refer to Section 2.6, "Using the Command Line Interface" .
2. At the CLI prompt, type:

```
sshpubkey list
```

A list of public keys will appear, including their key ID, access level, revocation status, user name and key fingerprint.

Section 3.4.3.4
Updating a Public Key

Admin users can update public keys.

To update public keys, do the following:

1. Log in to the device as an admin user and access the CLI shell. For more information about accessing the CLI shell, refer to Section 2.6, "Using the Command Line Interface" .
2. At the CLI prompt, type:

```
sshpubkey list
```

A list of public keys will appear, including their key ID, access level, revocation status, user name and key fingerprint.

3. Type the following commands to update the public keys:

Command	Description
sshpubkey update_id *current_ID new_ID*	Updates the ID of user public key. **NOTE** *The user public key ID must be a number between 0 and 9999.* • *current_ID* is the ID currently assigned to the public key • *new_ID* is the ID that will be used to identify the public key going forward
sshpubkey update_al *AL*	Updates the access level of a user public key. • *AL* is the access level (admin, operator or guest) of the public key to be updated
sshpubkey update_rs *RS*	Updates the revocation status (active, inactive) of a user public key.

Command	Description
	• *RS* is the revocation status of the public key to be updated
sshpubkey update_un *UN*	Updates the user name of a user public key. • *UN* is the user name of the public key to be updated

Section 3.4.3.5
Deleting a Public Key

Admin users can delete one or more public keys.

To delete a public key, do the following:

1. Log in to the device as an admin user and access the CLI shell. For more information about accessing the CLI shell, refer to Section 2.6, "Using the Command Line Interface" .
2. At the CLI prompt, type:

```
sshpubkey list
```

   A list of public keys will appear, including access level, revocation status, user name and key fingerprint.
3. Type the following commands to delete the public key(s):

Command	Description
sshpubkey remove *ID*	Removes a key from the non-volatile storage. • *ID* is the ID of the public key to be removed

Section 3.4.4
Certificate and Key Examples

For SSL, controlled versions of RUGGEDCOM ROS require an X.509 certificate in standard PEM format and an RSA or ECC key pair. The certificate may be self-signed or signed by a separate authority. The RSA key must be 1024, 2048 or 3072 bits in length; the ECC key must be 192, 224, 256, 384 or 521 bits in length.

Non-Controlled (NC) versions of RUGGEDCOM ROS require an X.509 certificate in standard PEM format and an RSA key pair. The RSA key must be between 512 and 2048 bits in length.

The certificate and keys must be combined in a single `ssl.crt` file and uploaded to the device.

The following is an example of a combined SSL certificate and key:

```
-----BEGIN CERTIFICATE-----
MIIC9jCCAl+gAwIBAgIJAJh6rrehMt3iMA0GCSqGSIb3DQEBBQUAMIGuMQswCQYD
VQQGEwJDQTEQMA4GA1UECBMHT250YXJpbzEQMA4GA1UEBxMHQ29uY29yZDESMBAG
A1UEChMJUnVnZ2VkY29tMRkwFwYDVQQLExBDdXN0b21lciBTdXBwb3J0MSYwJAYD
VQQDEx1XUy1NSUxBTkdPVkFOLlJVR0dFRENPTS5MT0NBTDEkMCIGCSqGSIb3DQEJ
ARYVc3VwcG9ydEBydWdnZWRjb20uY29tMB4XDTEyMTAyMzIxMTA1M1oXDTE3MTAy
MjIxMTA1M1owgZwxCzAJBgNVBAYTAlVTMRAwDgYDVQQIEwdPbnRhcmlvMRAwDgYD
VQQHEwdDb25jb3JkMRIwEAYDVQQKEwlSdWdnZWRDb20xGTAXBgNVBAsTEEN1c3Rv
bWVyIFN1cHBvcnQxFDASBgNVBAMTCzE5Mi4xNjguMS4yMSQwIgYJKoZIhvcNAQkB
FhVTdXBwb3J0QHJ1Z2dlZGNvbS5jb20wgZ8wDQYJKoZIhvcNAQEBBQADgY0AMIGJ
AoGBALfE4eh2aY+CE3W5a4Wz1Z1RGRP02COHt153wFFrU8/fFQXNhKlQirlAHbNT
RSwcTR8ZFapivwYDivn0ogOGFXknYP90gv2oIaSVY08FqZkJW77g3kzkv/8Zrw3m
W/cBsZJ8SyKLIDfy401HkHpDOle5NsQFSrziGUPjAOIvvx4rAgMBAAGjLDAqMAkG
A1UdEwQCMAAwHQYDVR0OBBYEFER0utgQOifnrflnDtsqNcnvRB0XMA0GCSqGSIb3
DQEBBQUAA4GBAHtBsNZuh8tB3kdqR7Pn+XidCsD70YnI7w0tiy9yiRRhARmVXH8h
```

```
5Q1rOeHceri3JFFIOxIxQt4KgCUYJLu+c9Esk/nXQQar3zR7IQCt0qOABPkviiY8
c3ibVbhJjLpR2vNW4xRAJ+HkNNtBOg1xUlp4vOmJ2syYZR+7XAy/OP/S
-----END CERTIFICATE-----
-----BEGIN RSA PRIVATE KEY-----
MIICXAIBAAKBgQC3xOHodmmPghN1uWuFs9WdURkT9Ngjh7ded8BRa1PP3xUFzYSp
UIq5QB2zU0UsHE0fGRWqYr8GA4r59KIDhhV5J2D/dIL9qCGklWNPBamZCVu+4N5M
5L//Ga8N5lv3AbGSfEsiiyA38uNNR5B6QzpXuTbEBUq84hlD4wDiL78eKwIDAQAB
AoGBAI2CXHuHg23wuk9zAusoOhw0MN1/M1jYz0k9aajIvvdZT3Tyd29yCADy8GwA
eUmoWXLS/C4CcBqPa9til8ei3rDn/w8dveVHsi9FXjtVSYqN+ilKw+moMAjZy4kN
/kpdpHMohwv/909VWR1AZbr+YTxaG/++tKl5bqXnZl4wHF8xAkEA5vwut8USRg2/
TndOt1e8ILEQNHvHQdQr2et/xNH4ZEo7mqot6skkCD1xmxA6XG64hR3BfxFSZcew
Wr4SOFGCtQJBAMurr5FYPJRFGzPM3HwcpAaaMIUtPwNyTtTjywlYcUI7iZVVfbdx
4B7qOadPybTg7wqUrGVkPSzzQelz9YCSSV8CQFqpIsEYhbqfTLZEl83YjsuaE801
xBivaWLIT0b2TvM2O7zSDOG5fv4I990v+mgrQRtmeXshVmEChtKnBcm7HH0CQE6B
2WUfLArDMJ8hAoRczeU1nipXrIh5kWWCgQsTKmUrafdEQvdpT8ja5GpX2Rp98eaU
NHfI0cP36JpCdome2eUCQDZN9OrTgPfeDIXzyOiUUwFlzS1idkUGL9nH86iuPnd7
WVF3rV9Dse30sVEk63Yky8uKUy7yPUNWldG4U5vRKmY=
-----END RSA PRIVATE KEY-----
```

For SSH, RUGGEDCOM ROS requires a DSA or RSA host key pair in PEM format. The key must be 1024, 2048 or 3072 bits in length for Controlled versions. The key file is uploaded to the `ssh.keys` flash file on the device.

The following is an example of a PEM formatted SSH key:

```
-----BEGIN DSA PRIVATE KEY-----
MIIBuwIBAAKBgQD0gcGbXx/rrEMu2913UW4cYo1OlcbnuUz7OZyd2mBLDx/GYbD8
X5TnRcMraJ0RuuGK+chqQJW5k3zQmZa/BS6q9U7wYwIAx8JSxxpwfPfl/t09VwKG
rtSJIMpLRoDq3qEwEVyR4kDUo4LFQDsljtiyhcz1n6kd6gqsd5Xu1vdh4wIVANXb
SBi97GmZ6/9f4UCvIIBtXLEjAoGAAfmhkcCCEnRJitUTiCE+MurxdFUr3mFs/d31
4cUDaLStQEhYYmx5dbFdQuapl4Y32B7lZQkohi5q1T1iUAa40/nUnJx1hFvblkYT
8DLwxcuDAaiu0VqsaPtJ+baL2dYNp96tFisj/475PEEWBGbP6GSe5kKa1Zdgwuie
9LyPb+ACgYBv856v5tb9UVG5+tX5Crfv/Nd8FFlSSFKmVWW3yzguhHajg2LQg8UU
sm1/zPSwYQ0SbQ9aOAJnpLc2HUkK0lji/0oKVI7y9MMc4B+bGu4W4OnryP7oFpnp
YYHt5PJY+zvLw/Wa+u3NOVFHkF1tGyfVBMXeV36nowPo+wrVMolAEgIVALLTnfpW
maV6uh6RxeE1d4XoxSg2
-----END DSA PRIVATE KEY-----
```

Section 3.5

Uploading/Downloading Files

Files can be transferred between the device and a host computer using any of the following methods:

- Xmodem using the CLI shell over a Telnet or RS-232 console session
- TFTP client using the CLI shell in a console session and a remote TFTP server
- TFTP server from a remote TFTP client
- SFTP (secure FTP over SSH) from a remote SFTP client

IMPORTANT!
Scripts can be used to automate the management of files on the device. However, depending on the size of the target file(s), a delay between any concurrent write and read commands may be required, as the file may not have been fully saved before the read command is issued. A general delay of five seconds is recommended, but testing is encouraged to optimize the delay for the target file(s) and operating environment.

NOTE
The contents of the internal file system are fixed. New files and directories cannot be created, and existing files cannot be deleted. Only the files that can be uploaded to the device can be overwritten.

Files that may need to be uploaded or downloaded include:

- `main.bin` – the main RUGGEDCOM ROS application firmware image
- `boot.bin` – the boot loader firmware image
- `fpga.xsvf` – the FPGA firmware binary image
- `config.csv` – the complete configuration database, in the form of a comma-delimited ASCII text file
- `factory.txt` – Contains the MAC address, order code and serial number. Factory data must be signed.
- `banner.txt` – contains text that appears on the login screen

CONTENTS

Section 3.5.1

Uploading/Downloading Files Using XMODEM

To updload or download a file using XMODEM, do the following:

NOTE
This method requires a host computer that has terminal emulation or Telnet software installed and the ability to perform XMODEM transfers.

NOTE
Xmodem transfers can only be performed through the serial console, which is authenticated during login.

1. Establish a direct connection between the device and the host computer. For more information, refer to Section 2.1.1, "Connecting Directly" .
2. Log in to the device as an admin user and access the CLI shell. For more information about accessing the CLI shell, refer to Section 2.6, "Using the Command Line Interface" .

   NOTE
   The `send` *option sends files to the host computer, while the* `receive` *option pulls files from the host computer.*

3. At the CLI prompt, type:

   ```
   xmodem [ send | receive ]  filename
   ```

   Where:

   - *`filename`* is the name of the file (i.e. main.bin)

NOTE
*If available in the terminal emulation or Telnet software, select the **XModem 1K** protocol for transmission over the standard **XModem** option.*

4. When the device responds with

```
Press Ctrl-X to cancel
```

, launch the XMODEM transfer from the host computer. The device will indicate when the transfer is complete.

The following is an example from the CLI shell of a successful XMODEM file transfer:

```
>xmodem receive main.bin
Press Ctrl-X to cancel
Receiving data now ...C
Received 1428480 bytes. Closing file main.bin ...
main.bin transferred successfully
```

Section 3.5.2

Uploading/Downloading Files Using a TFTP Client

To upload or download a file using a TFTP client, do the following:

IMPORTANT!
TFTP does not define an authentication scheme. Any use of the TFTP client or server is considered highly insecure.

NOTE
This method requires a TFTP server that is accessible over the network.

1. Identify the IP address of the computer running the TFTP server.
2. Establish a direct connection between the device and a host computer. For more information, refer to Section 2.1.1, “Connecting Directly” .
3. Log in to the device as an admin user and access the CLI shell. For more information about accessing the CLI shell, refer to Section 2.6, “Using the Command Line Interface” .
4. At the CLI prompt, type:

```
tftp address [ get | put ] source-filename destination-filename
```

Where:

- `get` copies files from the host computer to the device
- `put` copies files from the device to the host computer
- *`address`* is the IP address of the computer running the TFTP server
- *`source-filename`* is the name of the file to be transferred
- *`destination-filename`* is the name of the file (on the device or the TFTP server) that will be replaced during the transfer

The following is an example of a successful TFTP client file transfer:

```
>tftp 10.0.0.1 get ROS-MPC83_Main_v5.0.0.bin main.bin
TFTP CMD: main.bin transfer ok. Please wait, closing file ...
```

```
TFTP CMD: main.bin loading successful.
```

Section 3.5.3

Uploading/Downloading Files Using a TFTP Server

To updload or download a file using a TFTP server, do the following:

IMPORTANT!
TFTP does not define an authentication scheme. Any use of the TFTP client or server is considered highly insecure.

NOTE
This method requires a host computer that has TFTP server software installed.

IMPORTANT!
Interaction with TFTP servers is strictly controlled within the device to prevent unauthorized access. Make sure the device is configured to accept the TFTP connection. For more information, refer to Section 3.9, "Configuring IP Services" .

1. Establish a direct connection between the device and the host computer. For more information, refer to Section 2.1.1, "Connecting Directly" .
2. Initialize the TFTP server on the host computer and launch the TFTP transfer. The server will indicate when the transfer is complete.

   The following is an example of a successful TFTP server exchange:

```
C:\>tftp -i 10.1.0.1 put C:\files\ROS-MPC83_Main_v5.0.0.bin main.bin
Transfer successful: 1428480 bytes in 4 seconds, 375617 bytes/s
```

Section 3.5.4

Uploading/Downloading Files Using an SFTP Server

SFTP (Secure File Transfer Protocol) is a file transfer mechanism that uses SSH to encrypt every aspect of file transfer between a networked client and server.

NOTE
The device does not have an SFTP client and, therefore, can only receive SFTP files from an external source. SFTP requires authentication for the file transfer.

To updload or download a file using an SFTP server, do the following:

NOTE
This method requires a host computer that has SFTP client software installed.

1. Establish an SFTP connection between the device and the host computer.
2. Launch the SFTP transfer. The client will indicate when the transfer is complete.

   The following is an example of a successful SFTP server exchange:

```
user@host$ sftp admin@ros_ip
Connecting to ros_ip...
admin@ros_ip's password:


sftp>
```

Section 3.6
Managing Logs

The crash (`crashlog.txt`) and system (`syslog.txt`) log files contain historical information about events that have occurred during the operation of the device.

The crash log contains debugging information related to problems that might have resulted in unplanned restarts of the device or which may effect the operation of the device. A file size of 0 bytes indicates that no unexpected events have occurred.

The system log contains a record of significant events including startups, configuration changes, firmware upgrades and database re-initializations due to feature additions. The system log will accumulate information until it is full, holding approximately 2 MB of data.

CONTENTS

Section 3.6.1
Viewing Local and System Logs

The local crash and system logs can both be downloaded from the device and viewed in a text editor. For more information about downloading log files, refer to Section 3.5, "Uploading/Downloading Files" .

To view the system log through the Web interface, navigate to ***Diagnostics » View System Log***. The **syslog.txt** form appears.

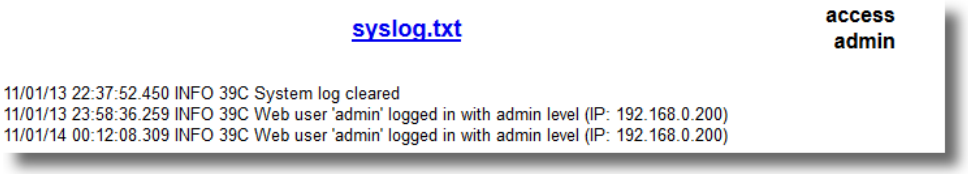


Figure 10: syslog.txt Form

Section 3.6.2
Clearing Local and System Logs

To clear both the local crash and system logs, log in to the CLI shell and type:

```
clearlogs
```

To clear only the local system log, log in to the Web interface and do the following:

1. Navigate to ***Diagnostics » Clear System Log***. The **Clear System Log** form appears.

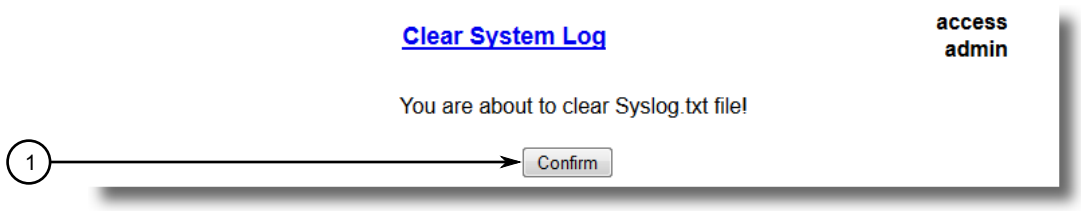


Figure 11: Clear System Log Form

1. Confirm Button

2. Click **Confirm**.

Section 3.6.3
Configuring the Local System Log

To configure the severity level for the local system log, do the following:

> **NOTE**
> *For maximum reliability, use remote logging. For more information, refer to* *Section 3.6.4, "Managing Remote Logging"* .

1. Navigate to ***Administration » Configure Syslog » Configure Local Syslog***. The **Local Syslog** form appears.

Figure 12: Local Syslog Form

1. Local Syslog Level **2.** Apply Button **3.** Reload Button

2. Configure the following parameter(s) as required:

Parameter	Description
Local Syslog Level	**Synopsis:** { EMERGENCY, ALERT, CRITICAL, ERROR, WARNING, NOTICE, INFORMATIONAL, DEBUGGING } **Default:** INFORMATIONAL The severity of the message that has been generated. Note that the severity level selected is considered the minimum severity level for the system. For example, if ERROR is selected, the system sends any syslog messages generated by Error, Critical, Alert and Emergency.

3. Click **Apply**.

Section 3.6.4

Managing Remote Logging

In addition to the local system log maintained on the device, a remote system log can be configured as well to collect important event messages. The syslog client resides on the device and supports up to 5 collectors (or syslog servers).

The remote syslog protocol, defined in RFC 3164, is a UDP/IP-based transport that enables the device to send event notification messages across IP networks to event message collectors, also known as syslog servers. The protocol is designed to simply transport these event messages from the generating device to the collector(s).

CONTENTS

Section 3.6.4.1

Configuring the Remote Syslog Client

To configure the remote syslog client, do the following:

1. Navigate to ***Administration » Configure Syslog » Configure Remote Syslog Client***. The **Remote Syslog Client** form appears.

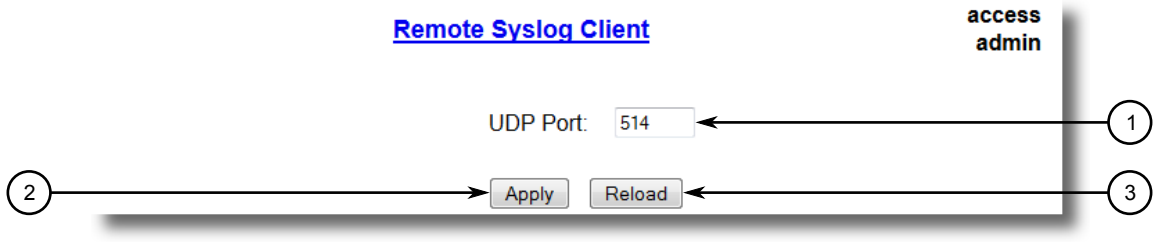


Figure 13: Remote Syslog Client Form

1. UDP Port **2.** Apply Button **3.** Reload Button

2. Configure the following parameter(s) as required:

Parameter	Description
UDP Port	**Synopsis:** 1025 to 65535 or { 514 } **Default:** 514 The local UDP port through which the client sends information to the server(s).

3. Click **Apply**.

Section 3.6.4.2
Viewing a List of Remote Syslog Servers

To view a list of known remote syslog servers, navigate to ***Administration » Configure Syslog » Configure Remote Syslog Server***. The **Remote Syslog Server** table appears.

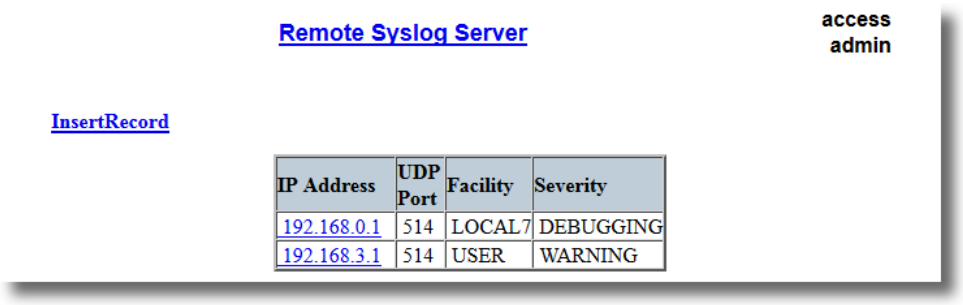


Figure 14: Remote Syslog Server Table

If remote syslog servers have not been configured, add the servers as needed. For more information, refer to Section 3.6.4.3, “Adding a Remote Syslog Server” .

Section 3.6.4.3
Adding a Remote Syslog Server

RUGGEDCOM ROS supports up to 5 remote syslog servers (or collectors). Similar to the local system log, a remote system log server can be configured to log information at a specific severity level. Only messages of a severity level equal to or greater than the specified severity level are written to the log.

To add a remote syslog server to the list of known servers, do the following:

1. Navigate to ***Administration » Configure Syslog » Configure Remote Syslog Server***. The **Remote Syslog Server** table appears.

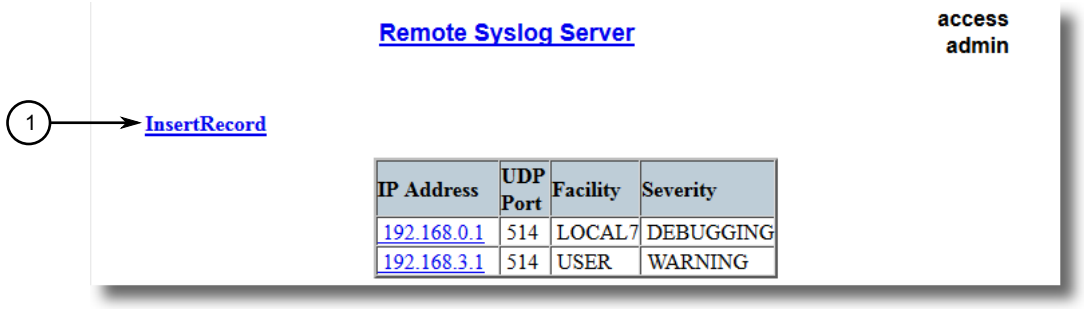


Figure 15: Remote Syslog Server Table

1. InsertRecord

2. Click **InsertRecord**. The **Remote Syslog Server** form appears.

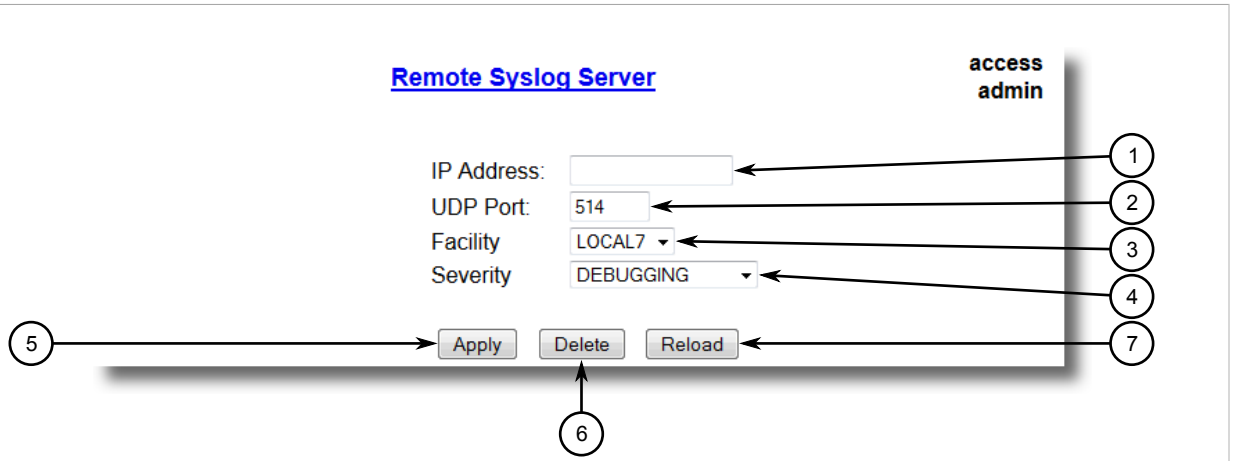


Figure 16: Remote Syslog Server Form

1. IP Address Box **2.** UDP Port Box **3.** Facility Box **4.** Severity Box **5.** Apply Button **6.** Delete Button **7.** Reload Button

3. Configure the following parameter(s) as required:

Parameter	Description
IP Address	**Synopsis:** ###.###.###.### where ### ranges from 0 to 255 Syslog server IP Address.
UDP Port	**Synopsis:** 1025 to 65535 or { 514 } **Default:** 514 The UDP port number on which the remote server listens.
Facility	**Synopsis:** { USER, LOCAL0, LOCAL1, LOCAL2, LOCAL3, LOCAL4, LOCAL5, LOCAL6, LOCAL7 } **Default:** LOCAL7 Syslog Facility is one information field associated with a syslog message. The syslog facility is the application or operating system component that generates a log message. ROS map all syslog logging information onto a single facility which is configurable by user to facilitate remote syslog server.

Parameter	Description
Severity	**Synopsis:** { EMERGENCY, ALERT, CRITICAL, ERROR, WARNING, NOTICE, INFORMATIONAL, DEBUGGING } **Default:** DEBUGGING The severity level is the severity of the message that has been generated. Please note that the severity level user select is accepted as the minimum severity level for the system. For example, if user selects the severity level as 'Error' then the system send any syslog message originated by Error, Critical, Alert and Emergency.

4. Click **Apply**.

Section 3.6.4.4
Deleting a Remote Syslog Server

To delete a remote syslog server from the list of known servers, do the following:

1. Navigate to ***Administration » Configure Syslog » Configure Remote Syslog Server***. The **Remote Syslog Server** table appears.

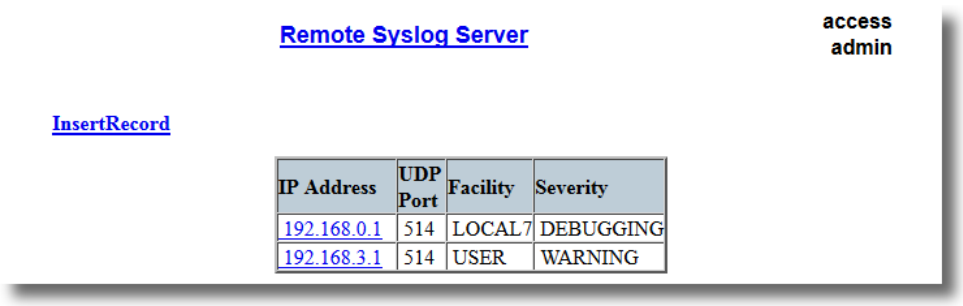


Figure 17: Remote Syslog Server Table

2. Select the server from the table. The **Remote Syslog Server** form appears.

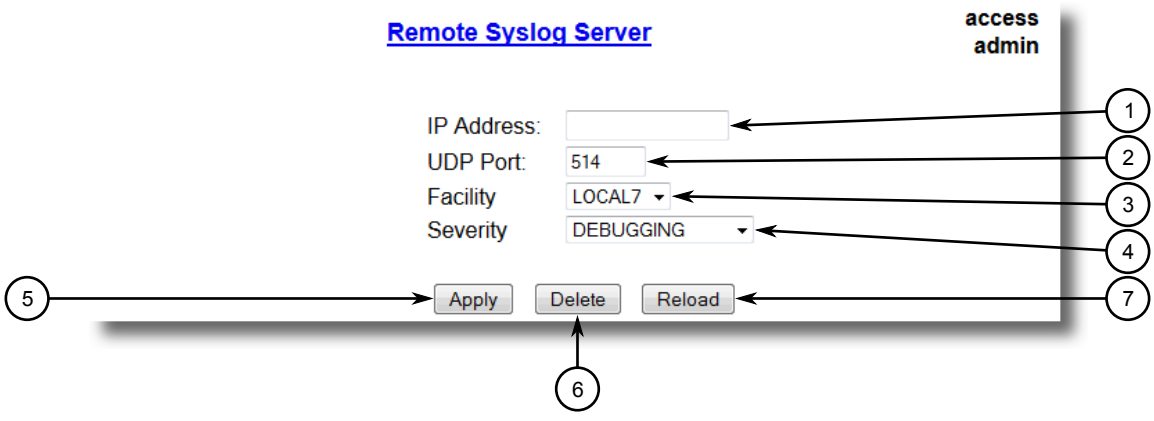


Figure 18: Remote Syslog Server Form

1. IP Address Box **2.** UDP Port Box **3.** Facility Box **4.** Severity Box **5.** Apply Button **6.** Delete Button **7.** Reload Button

3. Click **Delete**.

Section 3.7

Configuring the Management IP Interface

The management IP interface represents the management port on the device. Only one management IP interface can be configured.

To configure the management IP interface, do the following:

1. Navigate to ***Administration » Configure IP Interfaces » Configure Mgmt IP Interfaces***. The **Mgmt IP Interfaces** form appears.

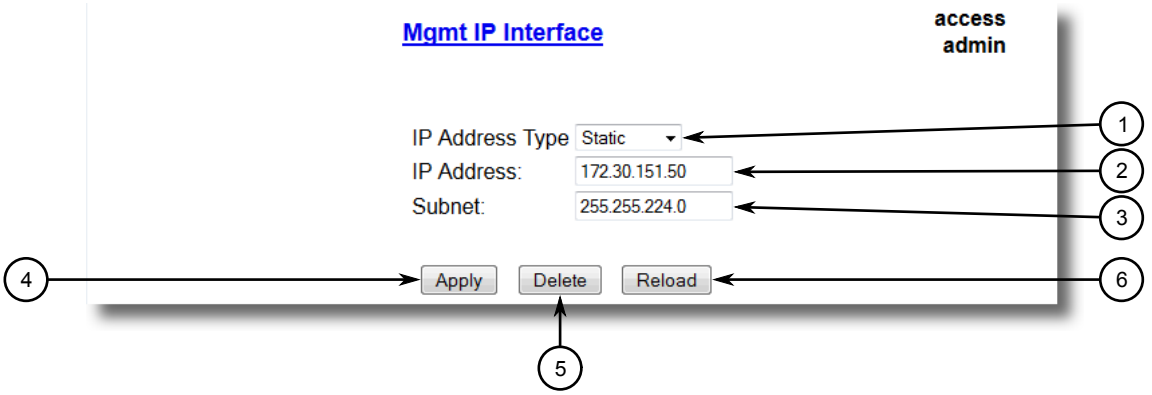


Figure 19: Mgmt IP Interface Form

1. IP Address Type Box **2.** IP Address Box **3.** Subnet Box **4.** Apply Button **5.** Delete Button **6.** Reload Button

2. Configure the following parameter(s) as required:

NOTE
The IP address and mask configured for the management VLAN are not changed when resetting all configuration parameters to defaults and will be assigned a default VLAN ID of 1. Changes to the IP address take effect immediately. All IP connections in place at the time of an IP address change will be lost.

Parameter	Description
IP Address Type	**Synopsis:** { Static, Dynamic, DHCP, BOOTP } **Default:** Static Specifies whether the IP address is static or dynamically assigned via DHCP or BOOTP. Option DYNAMIC is a common case of dynamically assigned IP address. It switches between BOOTP and DHCP until it gets the response from the relevant server.Must be static for non management interfaces
IP Address	**Synopsis:** ###.###.###.### where ### ranges from 0 to 255 **Default:** 10.0.0.1 Specifies the IP address of this device. An IP address is a 32-bit number that is notated by using four numbers from 0 through 255, separated by periods. Only a unicast IP address is allowed, which ranges from 1.0.0.0 to 233.255.255.255.
Subnet	**Synopsis:** ###.###.###.### where ### ranges from 0 to 255

Parameter	Description
	Default: 255.0.0.0 Specifies the IP subnet mask of this device. An IP subnet mask is a 32-bit number that is notated by using four numbers from 0 through 255, separated by periods. Typically, subnet mask numbers use either 0 or 255 as values (e.g. 255.255.255.0) but other numbers can appear. **IMPORTANT!** *Each IP interface must have a unique network address.*

3. Click **Apply**.

Section 3.8

Managing IP Gateways

RUGGEDCOM ROS allows up to ten IP gateways to be configured. When both the **Destination** and **Subnet** parameters are blank, the gateway is considered to be a default gateway.

NOTE
The default gateway configuration will not be changed when resetting all configuration parameters to their factory defaults.

CONTENTS

Section 3.8.1

Viewing a List of IP Gateways

To view a list of IP gateways configured on the device, navigate to ***Administration » Configure IP Gateways***. The **IP Gateways** table appears.

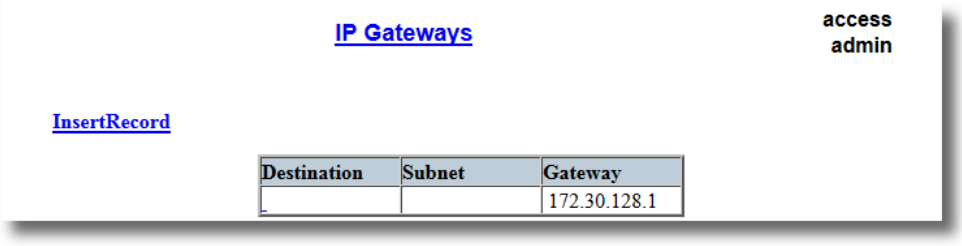


Figure 20: IP Gateways Table

If IP gateways have not been configured, add IP gateways as needed. For more information, refer to Section 3.8.2, "Adding an IP Gateway" .

Section 3.8.2
Adding an IP Gateway

IMPORTANT!
DHCP-provided IP gateway addresses will override manually configured values.

To add an IP gateway, do the following:

1. Navigate to ***Administration » Configure IP Gateways***. The **IP Gateways** table appears.

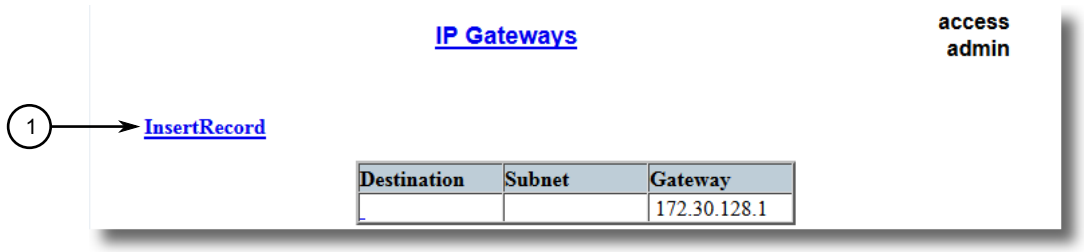


Figure 21: IP Gateways Table

1. InsertRecord

2. Click **InsertRecord**. The **IP Gateways** form appears.

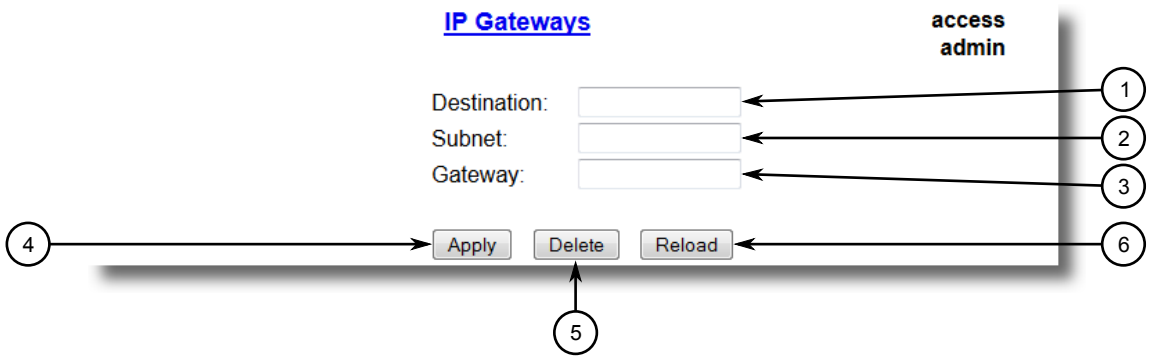


Figure 22: IP Gateways

1. Destination Box **2.** Subnet Box **3.** Gateway Box **4.** Apply Button **5.** Delete Button **6.** Reload Button

3. Configure the following parameter(s) as required:

Parameter	Description
Destination	**Synopsis:** ###.###.###.### where ### ranges from 0 to 255 Specifies the IP address of destination network or host. For default gateway, both the destination and subnet are 0.
Subnet	**Synopsis:** ###.###.###.### where ### ranges from 0 to 255 Specifies the destination IP subnet mask. For default gateway, both the destination and subnet are 0.

Parameter	Description
Gateway	**Synopsis:** ###.###.###.### where ### ranges from 0 to 255 Specifies the gateway to be used to reach the destination.

4. Click **Apply**.

Section 3.8.3
Deleting an IP Gateway

To delete an IP gateway configured on the device, do the following:

1. Navigate to ***Administration » Configure IP Gateways***. The **IP Gateways** table appears.

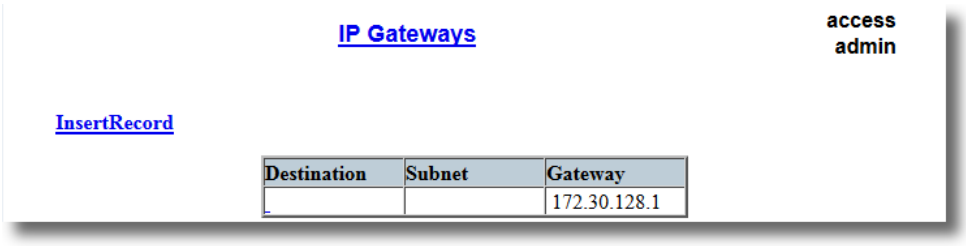


Figure 23: IP Gateways Table

2. Select the IP gateway from the table. The **IP Gateways** form appears.

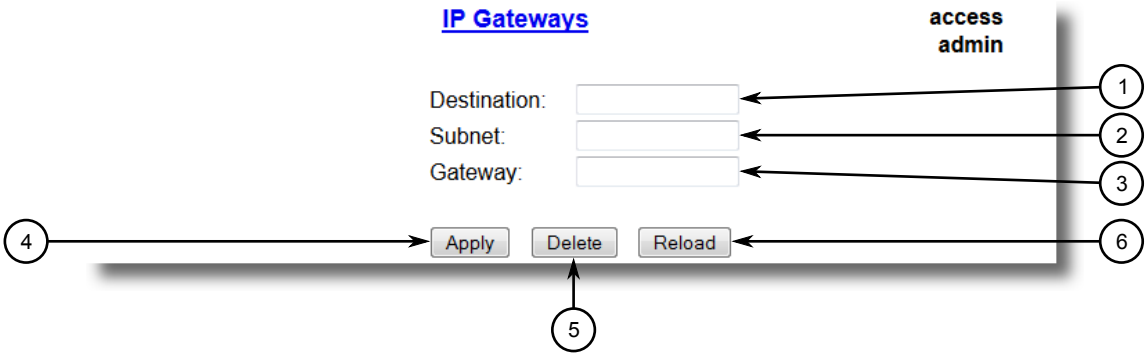


Figure 24: IP Gateways Form

1. Destination Box **2.** Subnet Box **3.** Gateway Box **4.** Apply Button **5.** Delete Button **6.** Reload Button

3. Click **Delete**.

Section 3.9
Configuring IP Services

To configure the IP services provided by the device, do the following:

1. Navigate to ***Administration » Configure IP Services***. The **IP Services** form appears.

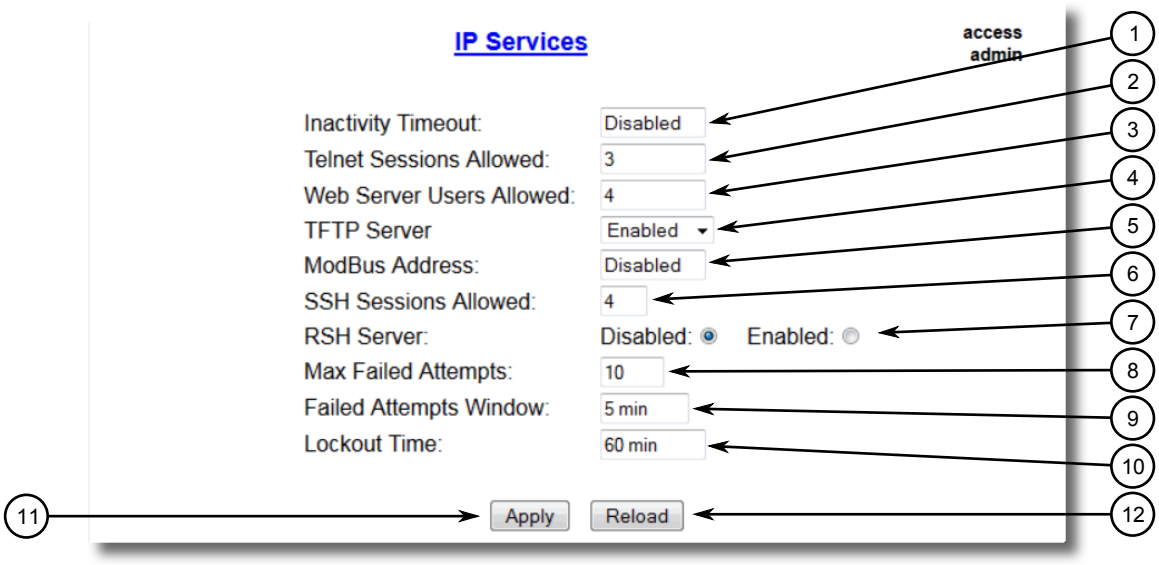


Figure 25: IP Services Form

1. Inactivity Timeout Box **2.** Telnet Sessions Allowed Box **3.** Web Server Users Allowed Box **4.** TFTP Server Box **5.** Modbus Address Box **6.** SSH Sessions Allowed Box **7.** RSH Server Options **8.** IP Forward Options **9.** Max Failed Attempts Box **10.** Failed Attempts Window Box **11.** Lockout Time Box **12.** Apply Button **13.** Reload Button

2. Configure the following parameter(s) as required:

Parameter	Description
Inactivity Timeout	**Synopsis:** 1 to 60 or { Disabled } **Default:** 5 min Specifies when the console will timeout and display the login screen if there is no user activity. A value of zero disables timeouts. For Web Server users maximum timeout value is limited to 30 minutes.
Telnet Sessions Allowed	**Synopsis:** 1 to 4 or { Disabled } **Default:** Disabled Limits the number of Telnet sessions. A value of zero prevents any Telnet access.
Web Server Users Allowed	**Synopsis:** 1 to 4 or { Disabled } **Default:** 4 Limits the number of simultaneous web server users.
TFTP Server	**Synopsis:** { Disabled, Get Only, Enabled } **Default:** Disabled As TFTP is a very insecure protocol, this parameter allows user to limit or disable TFTP Server access.. DISABLED - disables read and write access to TFTP Server GET ONLY - only allows reading of files via TFTP Server ENABLED - allows reading and writing of files via TFTP Server
ModBus Address	**Synopsis:** 1 to 255 or { Disabled } **Default:** Disabled Determines the Modbus address to be used for Management through Modbus.

Parameter	Description
SSH Sessions Allowed (Controlled Version Only)	**Synopsis:** 1 to 4 **Default:** 4 Limits the number of SSH sessions.
RSH Server	**Synopsis:** { Disabled, Enabled } **Default:** Disabled (controlled version) or Enabled (non-controlled version) Disables/enables Remote Shell access.
Failed Attempts Window	**Synopsis:** 1 to 30 min **Default:** 5 min The time in minutes (min) in which the maximum number of failed login attempts must be exceeded before a service is blocked. The counter of failed attempts resets to 0 when the timer expires.
Lockout Time	**Synopsis:** 1 to 120 min **Default:** 60 min The time in minutes (min) the service remains locked out after the maximum number of failed access attempts has been reached.

3. Click **Apply**.

Section 3.10
Upgrading/Downgrading Firmware

This section describes how to upgrade and downgrade the firmware for RUGGEDCOM ROS.

CONTENTS

Section 3.10.1
Upgrading Firmware

Upgrading RUGGEDCOM ROS firmware, including the main, bootloader and FPGA firmware, may be necessary to take advantage of new features or bug fixes. Binary firmware images are available from Siemens. Visit www.siemens.com/ruggedcom to determine which versions/updates are available or contact Siemens Customer Support.

Binary firmware images transferred to the device are stored in non-volatile Flash memory and require a device reset to take effect.

IMPORTANT!
Non-Controlled (NC) versions of RUGGEDCOM ROS can not be upgraded to Controlled firmware versions. However, Controlled firmware versions can be upgraded to an NC firmware version.

NOTE
The IP address set for the device will not be changed following a firmware upgrade.

To upgrade the RUGGEDCOM ROS firmware, do the following:

1. Upload a different version of the binary firmware image to the device. For more information, refer to Section 3.5, "Uploading/Downloading Files" .
2. Reset the device to complete the installation. For more information, refer to Section 3.11, "Resetting the Device" .
3. Access the CLI shell and verify the new software version has been installed by typing **`version`**. The currently installed versions of the main and boot firmware are displayed.

Section 3.10.2

Downgrading Firmware

Downgrading the RUGGEDCOM ROS firmware is generally not recommended, as it may have unpredictable effects. However, if a downgrade is required, do the following:

IMPORTANT!
Before downgrading the firmware, make sure the hardware and FPGA code types installed in the device are supported by the older firmware version. Refer to the Release Notes for the older firmware version to confirm.

IMPORTANT!
Non-Controlled (NC) versions of RUGGEDCOM ROS can not be downgraded to Controlled firmware versions. However, Controlled firmware versions can be downgraded to an NC firmware version.

CAUTION!
Do not downgrade the RUGGEDCOM ROS boot version.

1. Disconnect the device from the network.
2. Log in to the device as an admin user. For more information, refer to Section 2.2, "Logging In" .
3. Make a local copy of the current configuration file. For more information, refer to Section 3.5, "Uploading/Downloading Files" .

   IMPORTANT!
   Never downgrade the RUGGEDCOM ROS software version beyond RUGGEDCOM ROS v5.0 when encryption is enabled. Make sure the device has been restored to factory defaults before downgrading.
4. Restore the device to its factory defaults. For more information, refer to Section 3.3, "Restoring Factory Defaults" .
5. Upload and apply the older firmware version and its associated FPGA files using the same methods used to install newer firmware versions. For more information , refer to Section 3.10.1, "Upgrading Firmware" .
6. Press **Ctrl-S** to access the CLI.
7. Clear all logs by typing:

   ```
   clearlogs
   ```
8. Clear all alarms by typing:

   ```
   clearalarms
   ```

IMPORTANT!
After downgrading the firmware and FPGA files, be aware that some settings from the previous configuration may be lost or reverted back to the factory defaults (including user passwords if downgrading from a security related version), as those particular tables or fields may not exist in the older firmware version. Because of this, the unit must be configured after the downgrade.

9. Configure the device as required.

Section 3.11
Resetting the Device

To reset the device, do the following:

1. Navigate to ***Diagnostics » Reset Device***. The **Reset Device** form appears.

Figure 26: Reset Device Form

1. Confirm Button

2. Click **Confirm**.

Section 3.12
Decommissioning the Device

Before taking the device out of service, either permanently or for maintenance by a third-party, make sure the device has been fully decommissioned. This includes removing any sensitive, proprietary information.

To decommission the device, do the following:

1. Disconnect all network cables from the device.
2. Connect to the device via the RS-232 serial console port. For more information, refer to Section 2.1.1, "Connecting Directly" .
3. Restore all factory default settings for the device. For more information, refer to Section 3.3, "Restoring Factory Defaults" .
4. Access the CLI. For more information, refer to Section 2.6, "Using the Command Line Interface" .
5. Upload a blank version of the `banner.txt` file to the device to replace the existing file. For more information about uploading a file, refer to Section 3.5, "Uploading/Downloading Files" .
6. Confirm the upload was successful by typing:

```
type banner.txt
```

7. Clear the system and crash logs by typing:

```
clearlog
```

8. Generate a random SSL certificate by typing:

   ```
   sslkeygen
   ```

   This may take several minutes to complete. To verify the certificate has been generated, type:

   ```
   type syslog.txt
   ```

   When the phrase

   ```
   Generated ssl.crt was saved
   ```

   appears in the log, the SSL certificate has been generated.
9. Generate random SSH keys by typing:

   ```
   sshkeygen
   ```

   This may take several minutes to complete. To verify the keys have been generated, type:

   ```
   type syslog.txt
   ```

   When the phrase

   ```
   Generated ssh.keys was saved
   ```

   appears in the log, the SSH keys have been generated.
10. De-fragment and erase all free flash memory by typing:

    ```
    flashfile defrag
    ```

    This may take several minutes to complete.

4 System Administration

This chapter describes how to perform various administrative tasks related to device identification, user permissions, alarm configuration, certificates and keys, and more.

CONTENTS

Section 4.1

Configuring the System Information

To configure basic information that can be used to identify the device, its location, and/or its owner, do the following:

1. Navigate to ***Administration » Configure System Identification***. The **System Identification** form appears.

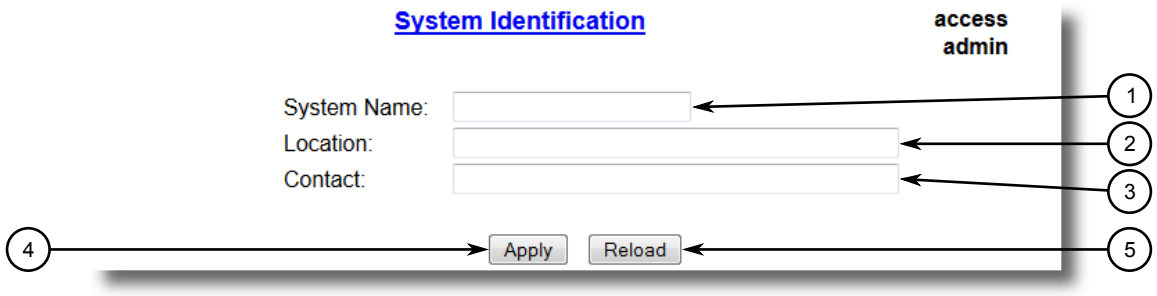


Figure 27: System Identification Form

1. System Name Box **2.** Location Box **3.** Contact Box **4.** Apply Button **5.** Reload Button

2. Configure the following parameter(s) as required:

Parameter	Description
System Name	**Synopsis:** Any 24 characters The system name is displayed in all RUGGEDCOM ROS menu screens. This can make it easier to identify the switches within your network provided that all switches are given a unique name.
Location	**Synopsis:** Any 49 characters The location can be used to indicate the physical location of the switch. It is displayed in the login screen as another means to ensure you are dealing with the desired switch.
Contact	**Synopsis:** Any 49 characters The contact can be used to help identify the person responsible for managing the switch. You can enter name, phone number, email, etc. It is displayed in the login screen so that this person may be contacted should help be required.

3. Click **Apply**.

Section 4.2
Customizing the Login Screen

To display a custom welcome message, device information or any other information on the login screen for the Web and console interfaces, add text to the `banner.txt` file stored on the device.

If the `banner.txt` file is empty, only the **Username** and **Password** fields appear on the login screen.

To update the `banner.txt` file, download the file from the device, modify it and then load it back on to the device. For information about uploading and downloading files, refer to Section 3.5, “Uploading/Downloading Files” .

Section 4.3
Configuring Passwords

RUGGEDCOM ROS allows for up to three user profiles to be configured locally on the device. Each profile corresponds to one of the following access levels:

- Guest
- Operator
- Admin

The access levels provide or restrict the user's ability to change settings and execute various commands.

Rights	User Type		
	Guest	Operator	Admin
View Settings	✓	✓	✓
Clear Logs	×	✓	✓
Reset Alarms	×	✓	✓
Clear Statistics	×	✓	✓
Change Basic Settings	×	✓	✓

Rights	User Type		
	Guest	Operator	Admin
Change Advanced Settings	×	×	✓
Run Commands	×	×	✓

Default passwords are configured for each user type initially. It is strongly recommended that these be changed before the device is commissioned.

NOTE
Users can also be verified through a RADIUS or TACACS+ server. When enabled for authentication and authorization, the RADIUS or TACACS+ server will be used in the absence of any local settings. For more information about configuring a RADIUS or TACACS+ server, refer to *Section 4.8, "Managing an Authentication Server"*.

CAUTION!
To prevent unauthorized access to the device, make sure to change the default passwords for each profile before commissioning the device.

To configure passwords for one or more of the user profiles, do the following:

1. Navigate to ***Administration » Configure Passwords***. The **Configure Passwords** form appears.

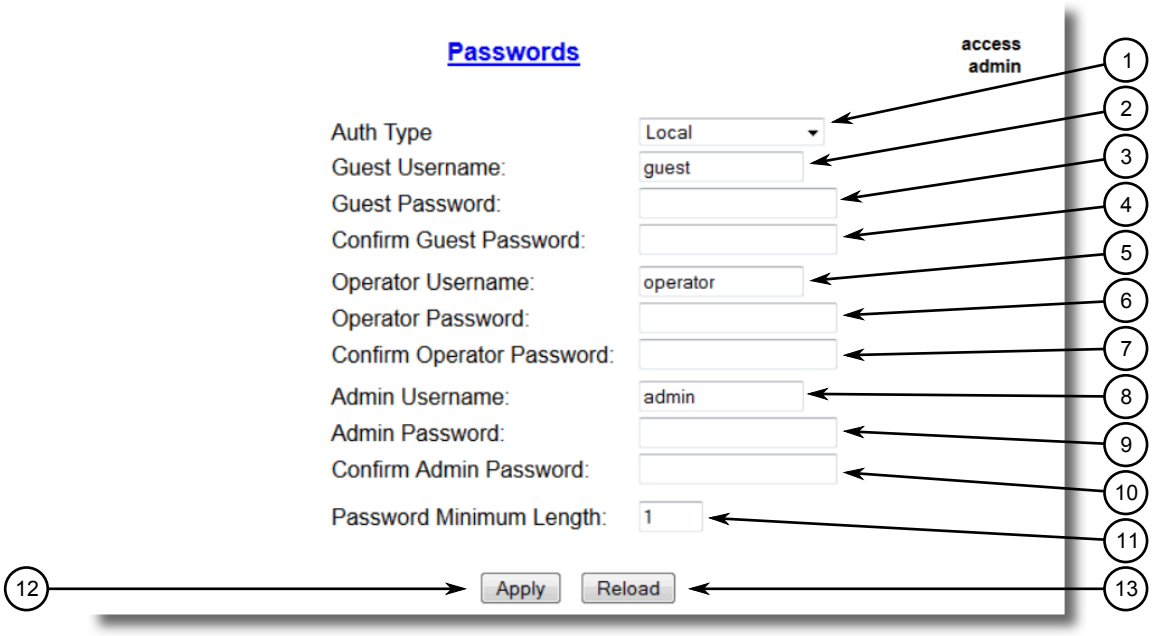


Figure 28: Configure Passwords Form

1. Auth Type Box **2.** Guest Username Box **3.** Guest Password Box **4.** Confirm Guest Password Box **5.** Operator Username Box **6.** Operator Password Box **7.** Confirm Operator Password Box **8.** Admin Username Box **9.** Admin Password Box **10.** Confirm Admin Password Box **11.** Password Minimum Length box **12.** Apply Button **13.** Reload Button

NOTE

RUGGEDCOM ROS requires that all user passwords meet strict guidelines to prevent the use of weak passwords. When creating a new password, make sure it adheres to the following rules:

- *Must not be less than 8 characters in length.*
- *Must not include the username or any 4 continous characters found in the username. For example, if the username is **Subnet25**, the password may not be **subnet25admin**, **subnetadmin** or **net25admin**. However, **net-25admin** or **Sub25admin** is permitted.*
- *Must have at least one alphabetic character and one number. Special characters are permitted.*
- *Must not have more than 3 continuously incrementing or decrementing numbers. For example, **Sub123** and **Sub19826** are permitted, but **Sub12345** is not.*

An alarm will generate if a weak password is configured. The weak password alarm can be disabled by the user. For more information about disabling alarms, refer to *Section 4.6, "Managing Alarms"* *.*

2. Configure the following parameter(s) as required:

Parameter	Description
Auth Type	**Synopsis:** { Local, RADIUS, TACACS+, RADIUSorLocal, TACACS+orLocal } **Default:** Local Password can be authenticated using localy configured values, or remote RADIUS or TACACS+ server. Setting value to any of combinations that involve RADIUS or TACACS+ require Security Server Table to be configured. Settings: • Local - Authentication from the local Password Table. • RADIUS - Authentication using a RADIUS server. • TACACS+ - Authentication using a TACACS+ server. • RADIUSOrLocal - Authentication using RADIUS. If the server cannot be reached, authenticate from the local Password Table. • TACACS+OrLocal - Authentication using TACACS+. If the server cannot be reached, authenticate from the local Password Table **NOTE** *For console access, local credentials will always be checked first regardless of the device configuration. If server authentication is required, requests to the server will be sent only if local authentication fails.*
Guest Username	**Synopsis:** Any 15 characters **Default:** guest Related password is in field Guest Password; view only, cannot change settings or run any commands.
Guest Password	**Synopsis:** 19 character ASCII string Related username is in field Guest Username; view only, cannot change settings or run any commands.
Confirm Guest Password	**Synopsis:** 19 character ASCII string Related username is in field Guest Username; view only, cannot change settings or run any commands.
Operator Username	**Synopsis:** Any 15 characters **Default:** operator Related password is in field Oper Password; cannot change settings; can reset alarms, statistics, logs, etc.

Parameter	Description
Operator Password	**Synopsis:** 19 character ASCII string Related username is in field Oper Username; cannot change settings; can reset alarms, statistics, logs, etc
Confirm Operator Password	**Synopsis:** 19 character ASCII string Related username is in field Oper Username; cannot change settings; can reset alarms, statistics, logs, etc.
Admin Username	**Synopsis:** Any 15 characters **Default:** admin Related password is in field Admin Password; full read/write access to all settings and commands.
Admin Password	**Synopsis:** 19 character ASCII string Related username is in field Admin Username; full read/write access to all settings and commands.
Confirm Admin Password	**Synopsis:** 19 character ASCII string Related username is in field Admin Username; full read/write access to all settings and commands.
Password Minimum Length	**Synopsis:** 1 to 17 **Default:** 1 Configure the password string minimum length. The new password shorter than the minimum length will be rejected.

3. Click **Apply**.

Section 4.4
Clearing Private Data

When enabled, during system boot up, a user with serial console access can clear all configuration data and keys stored on the device, and restore all user names and passwords to factory default settings.

To clear private data, do the following:

> **NOTE**
> *The commands used in the following procedure are time-sensitive. If the specified time limits are exceeded before providing the appropriate response, the device will continue normal boot up.*

1. Connect to the device via the RS-232 serial console port. For more information, refer to Section 2.1.1, "Connecting Directly" .
2. Cycle power to the device. As the device is booting up, the following prompt will appear:

```
Press any key to start
```

3. Within four seconds, press **CTRL** + **r**. The access banner will appear, followed by the command prompt:

```
>
```

4. Type the following command, then press **Enter** within 30 seconds:

```
clear private data
```

5. When prompted "Do you want to clear private data (Yes/No)?", answer *yes* and press **Enter** within five seconds. All configuration and keys in flash will be zeroized. An entry in the event log will be created. Crashlog.txt files (if existing) and syslog.txt files will be preserved. The device will reboot automatically.

Section 4.5
Enabling/Disabling the Web Interface

In some cases, users may want to disable the web interface to increase cyber security.

To disable or enable the web interface, do the following:

NOTE
*The web interface can be disabled via the web UI by configuring the Web Server Users Allowed parameter in the **IP Services form**. For more information, refer to* *Section 3.9, "Configuring IP Services"* .

1. Log in to the device as an admin user and access the CLI shell. For more information about accessing the CLI shell, refer to Section 2.6, "Using the Command Line Interface" .
2. Navigate to ***Administration » Configure IP Services » Web Server Users Allowed***.
3. Select **Disabled** to disable the web interface, or select the desired number of web server users allowed to enable the interface.

Section 4.6
Managing Alarms

Alarms indicate the occurrence of events of either importance or interest that are logged by the device.

There are two types of alarms:

- **Active alarms** signify states of operation that are not in accordance with normal operation. Examples include links that should be up, but are not, or error rates that repeatedly exceed a certain threshold. These alarms are continuously active and are only cleared when the problem that triggered the alarms is resolved.
- **Passive alarms** are a record of abnormal conditions that occurred in the past and do not affect the current operation state of the device. Examples include authentication failures or error states that temporarily exceeded a certain threshold . These alarms can be cleared from the list of alarms.

When either type of alarm occurs, a message appears in the top right corner of the user interface. If more than one alarm has occurred, the message will indicate the number of alarms. Active alarms also trip the Critical Failure Relay LED on the device. The message and the LED will remain active until the alarm is cleared.

NOTE
Alarms are volatile in nature. All alarms (active and passive) are cleared at startup.

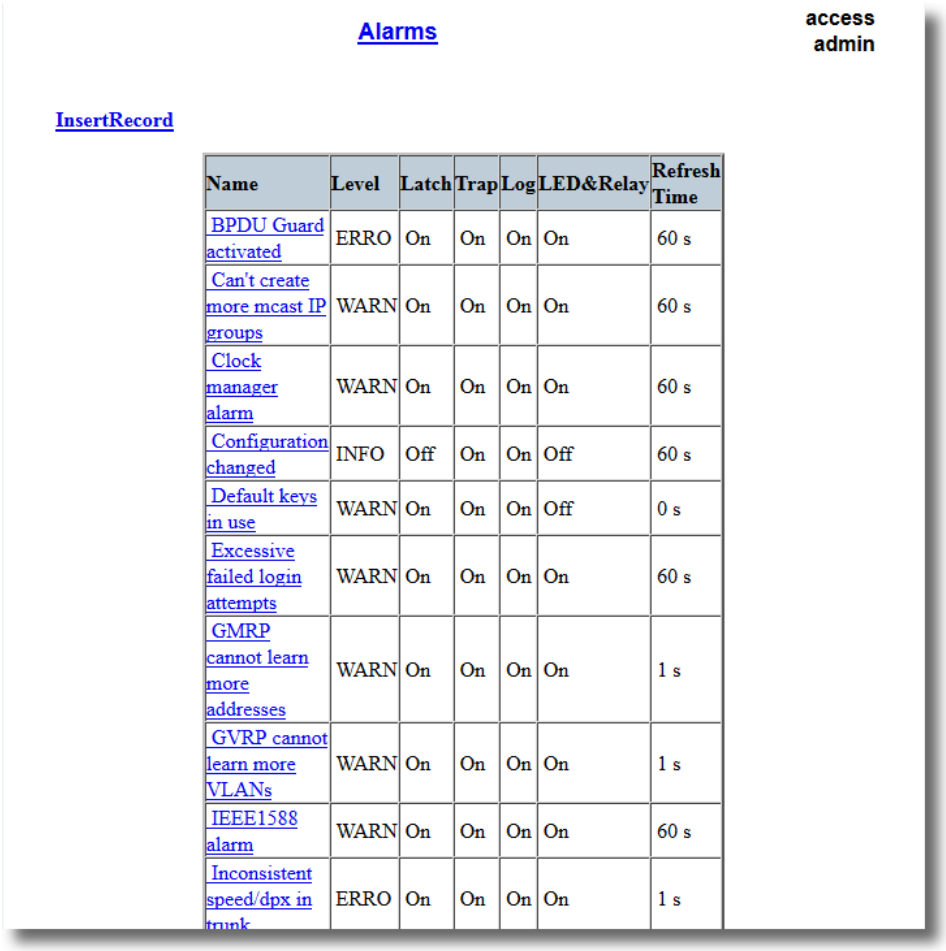
CONTENTS

- Section 4.6.4, "Authentication Related Security Alarms"

Section 4.6.1

Viewing a List of Pre-Configured Alarms

To view a list of alarms pre-configured for the device, navigate to ***Diagnostic » Configure Alarms***. The **Alarms** table appears.



Name	Level	Latch	Trap	Log	LED&Relay	Refresh Time
BPDU Guard activated	ERRO	On	On	On	On	60 s
Can't create more mcast IP groups	WARN	On	On	On	On	60 s
Clock manager alarm	WARN	On	On	On	On	60 s
Configuration changed	INFO	Off	On	On	Off	60 s
Default keys in use	WARN	On	On	On	Off	0 s
Excessive failed login attempts	WARN	On	On	On	On	60 s
GMRP cannot learn more addresses	WARN	On	On	On	On	1 s
GVRP cannot learn more VLANs	WARN	On	On	On	On	1 s
IEEE1588 alarm	WARN	On	On	On	On	60 s
Inconsistent speed/dpx in trunk	ERRO	On	On	On	On	1 s

Figure 29: Alarms Table

NOTE
This list of alarms (configurable and non-configurable) is accessible through the Command Line Interface (CLI) using the **`alarms`**. *For more information, refer to* *Section 2.6.1, "Available CLI Commands"* .

For information about modifying a pre-configured alarm, refer to Section 4.6.3, "Configuring an Alarm" .

Section 4.6.2
Viewing and Clearing Latched Alarms

To view a list of alarms that are configured to latch, navigate to ***Diagnostics » View Latched Alarms***. The **Latched Alarms** table appears.

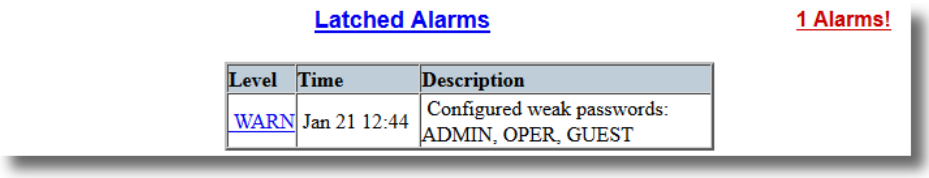


Figure 30: Latched Alarms Table

To clear the passive alarms from the list, do the following:

1. Navigate to ***Diagnostics » Clear Latched Alarms***. The **Clear Latched Alarms** form appears.

Figure 31: Clear Latched Alarms Form

1. Confirm Button

2. Click **Confirm**.

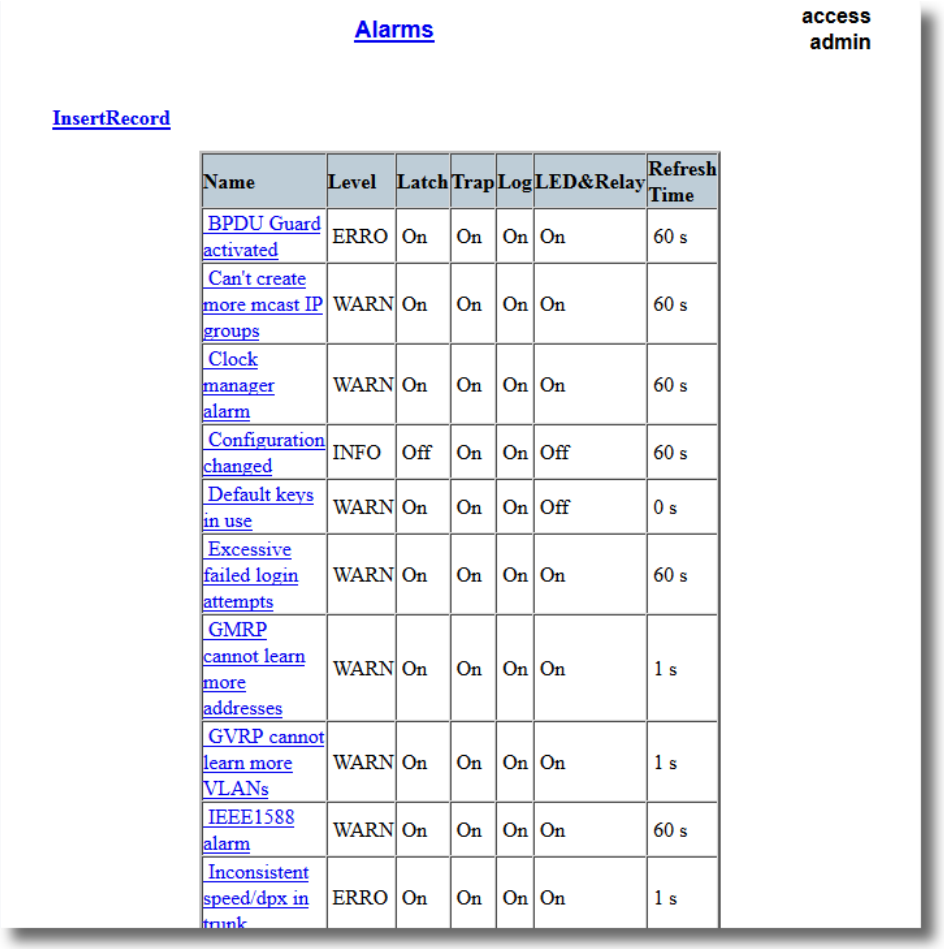
Section 4.6.3
Configuring an Alarm

While all alarms are pre-configured on the device, some alarms can be modified to suit the application. This includes enabling/disabling certain features and changing the refresh time.

To configuring an alarm, do the following:

IMPORTANT!
Critical and Alert level alarms are not configurable and cannot be disabled.

1. Navigate to ***Diagnostic » Configure Alarms***. The **Alarms** table appears.



Alarms

access admin

InsertRecord

Name	Level	Latch	Trap	Log	LED&Relay	Refresh Time
BPDU Guard activated	ERRO	On	On	On	On	60 s
Can't create more mcast IP groups	WARN	On	On	On	On	60 s
Clock manager alarm	WARN	On	On	On	On	60 s
Configuration changed	INFO	Off	On	On	Off	60 s
Default keys in use	WARN	On	On	On	Off	0 s
Excessive failed login attempts	WARN	On	On	On	On	60 s
GMRP cannot learn more addresses	WARN	On	On	On	On	1 s
GVRP cannot learn more VLANs	WARN	On	On	On	On	1 s
IEEE1588 alarm	WARN	On	On	On	On	60 s
Inconsistent speed/dpx in trunk	ERRO	On	On	On	On	1 s

Figure 32: Alarms Table

2. Select an alarm. The **Alarms** form appears.

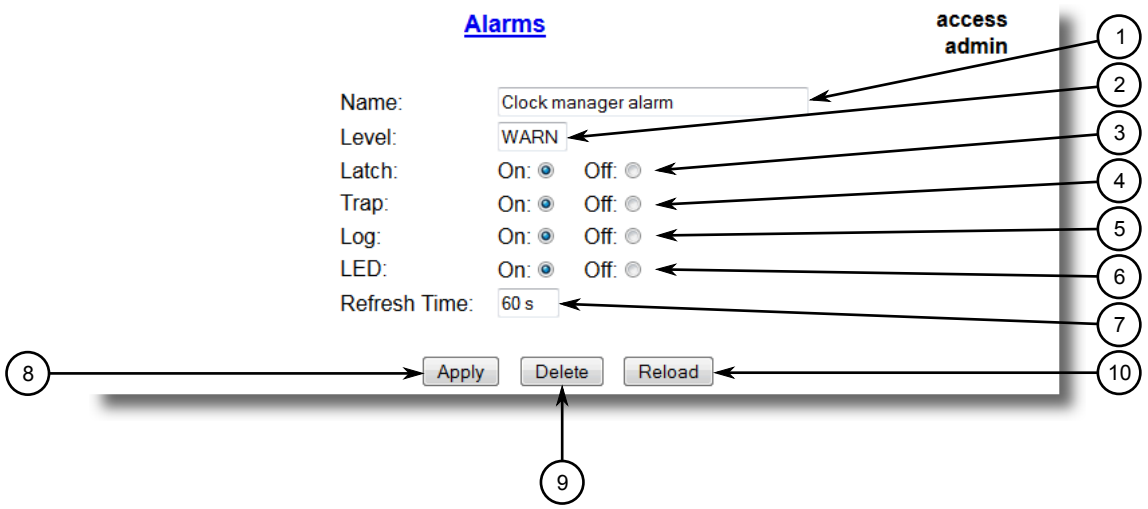


Figure 33: Alarms Form

1. Name Box **2.** Level Box **3.** Latch Box **4.** Trap Box **5.** Log Box **6.** LED & Relay Box **7.** Refresh Time Box **8.** Apply Button **9.** Reload Button

3. Configure the following parameter(s) as required:

Parameter	Description
Name	**Synopsis:** Any 34 characters **Default:** sys_alarm The alarm name, as obtained through the **`alarms`** CLI command.
Level	**Synopsis:** { EMRG, ALRT, CRIT, ERRO, WARN, NOTE, INFO, DEBG } Severity level of the alarm: • EMRG - The device has had a serious failure that caused a system reboot. • ALERT - The device has had a serious failure that did not cause a system reboot. • CRIT - The device has a serious unrecoverable problem. • ERRO - The device has a recoverable problem that does not seriously affect operation. • WARN - Possibly serious problem affecting overall system operation. • NOTE - Condition detected that is not expected or not allowed. • INFO - Event which is a part of normal operation, e.g. cold start, user login etc. • DEBG - Intended for factory troubleshooting only. This parameter is not configurable.
Latch	**Synopsis:** { On, Off } **Default:** Off Enables latching occurrence of this alarm in the Alarms Table.
Trap	**Synopsis:** { On, Off } **Default:** Off Enables sending an SNMP trap for this alarm.
Log	**Synopsis:** { On, Off } **Default:** Off Enables logging the occurrence of this alarm in syslog.txt.
LED	**Synopsis:** { On, Off } **Default:** Off

Parameter	Description
	Enables LED control for this alarm. If latching is not enabled, this field will remain disabled as well.
Refresh Time	**Synopsis:** 0 s to 60 s **Default:** 60 s Refreshing time for this alarm.

4. Click **Apply**.

Section 4.6.4

Authentication Related Security Alarms

This section describes the authentication-related security messages that can be generated by RUGGEDCOM ROS.

CONTENTS

Section 4.6.4.1

Security Alarms for Login Authentication

RUGGEDCOM ROS provides various logging options related to login authentication. A user can log into a RUGGEDCOM ROS device in three different ways: Console, SSH or Telnet. RUGGEDCOM ROS can log messages in the syslog, send a trap to notify an SNMP manager, and/or raise an alarm when a successful and unsuccessful login event occurs. In addition, when a weak password is configured on a unit or when the primary authentication server for TACACS+ or RADIUS is not reachable, RUGGEDCOM ROS will raise alarms, send SNMP traps and log messages in the syslog.

The following is a list of log and alarm messages related to user authentication:

- Weak Password Configured
- Login and Logout Information
- Excessive Failed Login Attempts
- RADIUS Server Unreachable
- TACACS Server Unreachable
- TACACS Response Invalid
- SNMP Authentication Failure

NOTE
All alarms and log messages related to login authentication are configurable. For more information about configuring alarms, refer to Section 4.6.3, "Configuring an Alarm".

» Weak Password Configured

RUGGEDCOM ROS generates this alarm and logs a message in the syslog when a weak password is configured in the **Passwords** table.

Message Name	Alarm	SNMP Trap	Syslog
Weak Password Configured	Yes	Yes	Yes

Default Keys In Use

RUGGEDCOM ROS generates this alarm and logs a message in the syslog when default keys are in use. For more information about default keys, refer to Section 3.4, "Managing SSH and SSL Keys and Certificates" .

NOTE
For Non-Controlled (NC) versions of RUGGEDCOM ROS, this alarm is only generated when default SSL keys are in use.

Message Name	Alarm	SNMP Trap	Syslog
Default Keys In Use	Yes	Yes	Yes

Login and Logout Information

RUGGEDCOM ROS generates this alarm and logs a message in the syslog when a successful and unsuccessful login attempt occurs. A message is also logged in the syslog when a user with a certain privilege level is logged out from the device.

Login attempts are logged regardless of how the user accesses the device (i.e. SSH, Web, Console, Telnet or RSH). However, when a user logs out, a message is only logged when the user is accessing the device through SSH, Telnet or Console.

Message Name	Alarm	SNMP Trap	Syslog
Successful Login	Yes	Yes	Yes
Failed Login	Yes	Yes	Yes
User Logout	No	No	Yes

Excessive Failed Login Attempts

RUGGEDCOM ROS generates this alarm and logs a message in the syslog after 10 failed login attempts by a user occur within a span of five minutes. Furthermore, the service the user attempted to access will be blocked for one hour to prevent further attempts.

Message Name	Alarm	SNMP Trap	Syslog
Excessive Failed Login Attempts	Yes	Yes	Yes

RADIUS Server Unreachable

RUGGEDCOM ROS generates this alarm and logs a message in the syslog when the primary RADIUS server is unreachable.

Message Name	Alarm	SNMP Trap	Syslog
Primary RADIUS Server Unreachable	Yes	Yes	Yes

TACACS+ Server Unreachable

RUGGEDCOM ROS generates this alarm and logs a message in the syslog when the primary TACACS+ server is unreachable.

Message Name	Alarm	SNMP Trap	Syslog
Primary TACACS Server Unreachable	Yes	Yes	Yes

TACACS+ Response Invalid

RUGGEDCOM ROS generate this alarm and logs a message in the syslog when the response from the TACACS+ server is received with an invalid CRC.

Message Name	Alarm	SNMP Trap	Syslog
TACACS Response Invalid	Yes	Yes	Yes

SNMP Authentication Failure

RUGGEDCOM ROS generates this alarm, sends an authentication failure trap, and logs a message in the syslog when an SNMP manager with incorrect credentials communicates with the SNMP agent in RUGGEDCOM ROS.

Message Name	Alarm	SNMP Trap	Syslog
SNMP Authentication Failure	Yes	Yes	Yes

Section 4.6.4.2

Security Messages for Port Authentication

The following is the list of log and alarm messages related to port access control in RUGGEDCOM ROS:

- MAC Address Authorization Failure
- Port Security Violated

MAC Address Authorization Failure

RUGGEDCOM ROS generates this alarm and logs a message in the syslog when a host connected to a secure port on the device is communicating using a source MAC address which has not been authorized by RUGGEDCOM ROS, or the dynamically learned MAC address has exceeded the total number of MAC addresses configured to be learned dynamically on the secured port. This message is only applicable when the port security mode is set to *Static MAC*.

Message Name	Alarm	SNMP Trap	Syslog
MAC Address Authorization Failure	Yes	Yes	Yes

Secure Port X Learned MAC Addr on VLAN X

RUGGEDCOM ROS logs a message in the syslog and sends a configuration change trap when a MAC address is learned on a secure port. Port X indicates the secured port number and VLAN number on that port. This message is not configurable in RUGGEDCOM ROS.

Message Name	SNMP Trap	Syslog
Secure Port X Learned MAC Addr on VLAN X	Yes	Yes

Port Security Violated

This message is only applicable when the security mode for a port is set to "802.1X or 802.1X/MAC-Auth"

RUGGEDCOM ROS this alarm and logs a message in the syslog when the host connected to a secure port tries to communicate using incorrect login credentials.

Message Name	Alarm	SNMP Trap	Syslog
802.1X Port X Authentication Failure	Yes	Yes	Yes
802.1X Port X Authorized Addr. XXX	No	No	Yes

Section 4.7

Managing the Configuration File

The device configuration file for RUGGEDCOM ROS is a single CSV (Comma-Separate Value) formatted ASCII text file, named `config.csv`. It can be downloaded from the device to view, compare against other configuration files, or store for backup purposes. It can also be overwritten by a complete or partial configuration file uploaded to the device.

To prevent unauthorized access to the contents of the configuration file, the file can be encrypted and given a password/passphrase key.

CONTENTS

Section 4.7.1

Configuring Data Encryption

To encrypt the configuration file and protect it with a password/passphrase, do the following:

NOTE
Data encryption is not available in Non-Controlled (NC) versions of RUGGEDCOM ROS. When switching between Controlled and Non-Controlled (NC) versions of RUGGEDCOM ROS, make sure data encryption is disabled. Otherwise, the NC version of RUGGEDCOM ROS will ignore the encrypted configuration file and load the factory defaults.

NOTE
Only configuration data is encrypted. All comments and table names in the configuration file are saved as clear text.

NOTE
When sharing a configuration file between devices, make sure both devices have the same passphrase configured. Otherwise, the configuration file will be rejected.

NOTE
Encryption must be disabled before the device is returned to Siemens or the configuration file is shared with Customer Support.

IMPORTANT!
Never downgrade the RUGGEDCOM ROS software version beyond RUGGEDCOM ROS v5.0 when encryption is enabled. Make sure the device has been restored to factory defaults before downgrading.

1. Navigate to ***Administration » Configure Data Storage***. The **Data Storage** form appears.

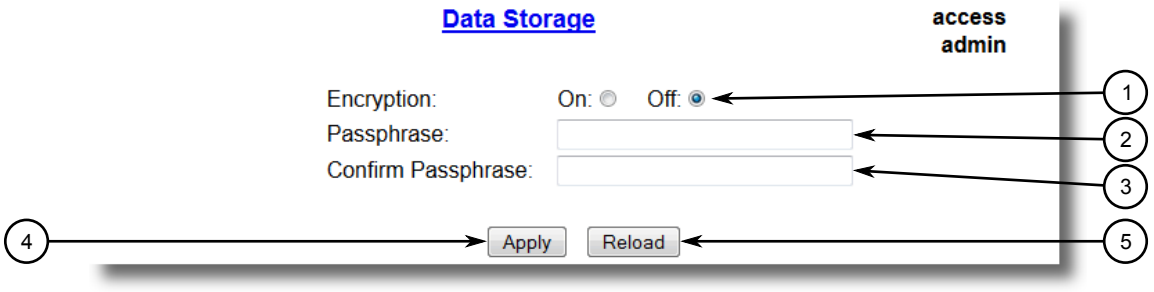


Figure 34: Data Storage Form

1. Encryption Options **2.** Passphrase Box **3.** Confirm Passphrase Box **4.** Apply Button **5.** Reload Button

2. Configure the following parameter(s) as required:

Parameter	Description
Encryption	**Synopsis:** { On, Off } Enable/disable encryption of data in configuration file.
Passphrase	**Synopsis:** 31 character ascii string This passphrase is used as a secret key to encrypt the configuration data. Encrypted data can be decrypted by any device configured with the same passphrase.
Confirm Passphrase	**Synopsis:** 31 character ascii string This passphrase is used as a secret key to encrypt the configuration data. Encrypted data can be decrypted by any device configured with the same passphrase.

3. Click **Apply**.

Section 4.7.2
Updating the Configuration File

Once downloaded from the device, the configuration file can be updated using a variety of different tools:

NOTE
For information about uploading/downloading files, refer to *Section 3.5, "Uploading/Downloading Files"* .

- Any text editing program capable of reading and writing ASCII files
- Difference/patching tools (e.g. the UNIX *diff* and *patch* command line utilities)
- Source Code Control systems (e.g. CVS, SVN)

CAUTION!
Configuration hazard – risk of data loss. Do not edit an encrypted configuration file. Any line that has been modified manually will be ignored.

RUGGEDCOM ROS also has the ability to accept partial configuration updates. For example, to update only the parameters for Ethernet port 1 and leave all other parameters unchanged, transfer a file containing only the following lines to the device:

```
# Port Parameters
ethPortCfg
Port,Name,Media,State,AutoN,Speed,Dupx,FlowCtrl,LFI,Alarm,
1,Port 1,100TX,Enabled,On,Auto,Auto,Off,Off,On,
```

Section 4.8

Managing an Authentication Server

This section describes how to manage RADIUS and TACACS+ authentication.

CONTENTS

Section 4.8.1

Managing RADIUS Authentication

RUGGEDCOM ROS can be configured to act as a RADIUS client and forward user credentials to a RADIUS (Remote Authentication Dial In User Service) server for remote authentication and authorization.

RADIUS is a UDP-based protocol used for carrying authentication, authorization and configuration information between a Network Access Server (NAS) that desires to authenticate its links and a shared authentication server. It provides centralized authentication and authorization for network access.

RADIUS is also widely used in conjunction with the IEEE 802.1X standard for port security using the Extensible Authentication Protocol (EAP).

IMPORTANT!
RADIUS messages are sent as UDP messages. The switch and the RADIUS server must use the same authentication and encryption key.

IMPORTANT!
RUGGEDCOM ROS supports both Protected Extensible Authentication Protocol (PEAP) and EAP-MD5. PEAP is more secure and is recommended if available in the supplicant.

NOTE
For more information about the RADIUS protocol, refer to RFC 2865.

For more information about the Extensible Authentication Protocol (EAP), refer to RFC 3748.

In a RADIUS access request, the following attributes and values are typically sent by the RADIUS client to the RADIUS server:

Attribute	Value
User-Name	{ Guest, Operator, Admin }
User-Password	{ password }
Service-Type	1
Vendor-Specific	Vendor-ID: 15004 Type: 1 Length: 11 String: RuggedCom

A RADIUS server may also be used to authenticate access on ports with 802.1X security support. When this is required, the following attributes are sent by the RADIUS client to the RADIUS server:

Attribute	Value
User-Name	{ The username as derived from the client's EAP identity response }
NAS-IP-Address	{ The Network Access Server IP address }
Service-Type	2
Frame-MTU	1500
EAP-Message[a]	{ A message(s) received from the authenticating peer }

[a] *EAP-Message is an extension attribute for RADIUS, as defined by RFC 2869.*

CONTENTS

Section 4.8.1.1
Configuring the RADIUS Server

The Vendor-Specific attribute (or VSA) sent to the RADIUS server as part of the RADIUS request is used to determine the access level from the RADIUS server. This attribute may be configured within the RADIUS server with the following information:

Attribute	Value
Vendor-Specific	Vendor-ID: 15004 Format: String Number: 2

Attribute	Value
	Attribute: { Guest, Operator, Admin }

NOTE
If no access level is received in the response packet from the RADIUS server, access is denied.

Section 4.8.1.2
Configuring the RADIUS Client

The RADIUS client can be configured to use two RADIUS servers: a primary server and a backup server. If the primary server is unavailable, the device will automatically attempt to connect with the backup server.

NOTE
The RADIUS client uses the Password Authentication Protocol (PAP) to verify access.

To configure access to either the primary or backup RADIUS servers, do the following:

1. Navigate to ***Administration » Configure Security Server » Configure RADIUS Server***. The **RADIUS Server** table appears.

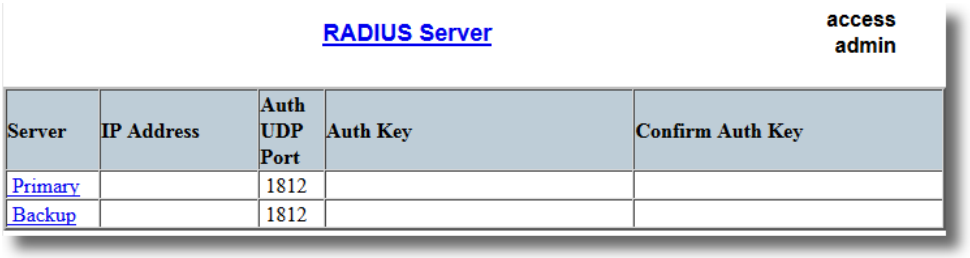


Figure 35: RADIUS Server Table

2. Select either **Primary** or **Backup** from the table. The **RADIUS Server** form appears.

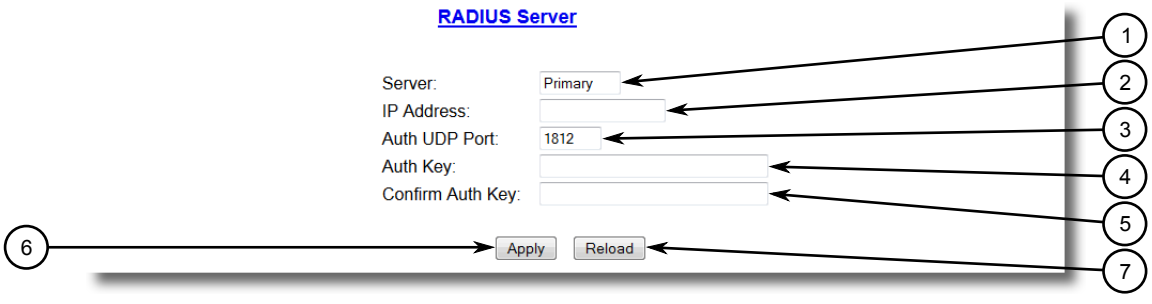


Figure 36: RADIUS Server Form

1. Server Box **2.** IP Address Box **3.** Auth UDP Port Box **4.** Auth Key Box **5.** Confirm Auth Key Box **6.** Apply Button **7.** Reload Button

3. Configure the following parameter(s) as required:

Parameter	Description
Server	**Synopsis:** Any 8 characters **Default:** Primary This field tells whether this configuration is for a Primary or a Backup Server.
IP Address	**Synopsis:** ###.###.###.### where ### ranges from 0 to 255 The Server IP Address.
Auth UDP Port	**Synopsis:** 1 to 65535 **Default:** 1812 The IP Port on server.
Auth Key	**Synopsis:** 31 character ASCII string The authentication key to be shared with server.
Confirm Auth Key	**Synopsis:** 31 character ASCII string The authentication key to be shared with server.

4. Click **Apply**.

Section 4.8.2
Managing TACACS+ Authentication

TACACS+ (Terminal Access Controller Access-Control System Plus) is a TCP-based access control protocol that provides authentication, authorization and accounting services to routers, Network Access Servers (NAS) and other networked computing devices via one or more centralized servers.

CONTENTS

Section 4.8.2.1
Configuring TACACS+

RUGGEDCOM ROS can be configured to use two TACACS+ servers: a primary server and a backup server. If the primary server is unavailable, the device will automatically attempt to connect with the backup server.

To configure access to either the primary or backup TACACS+ servers, do the following:

1. Navigate to ***Administration » Configure Security Server » Configure TacPlus Server » Configure TACACS Plus Server***. The **TACACS Plus Server** table appears.

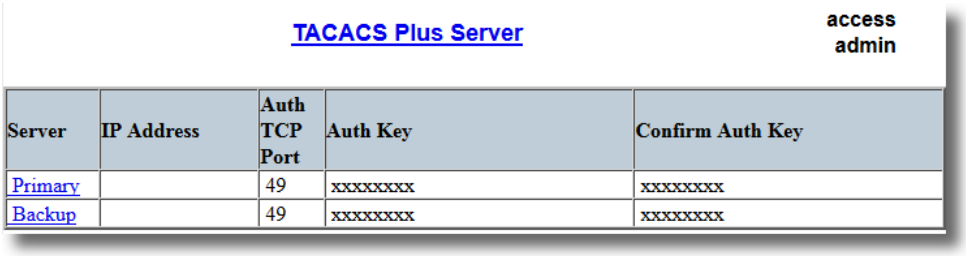


Figure 37: TACACS Plus Server Table

2. Select either **Primary** or **Backup** from the table. The **TACACS Plus Server** form appears.

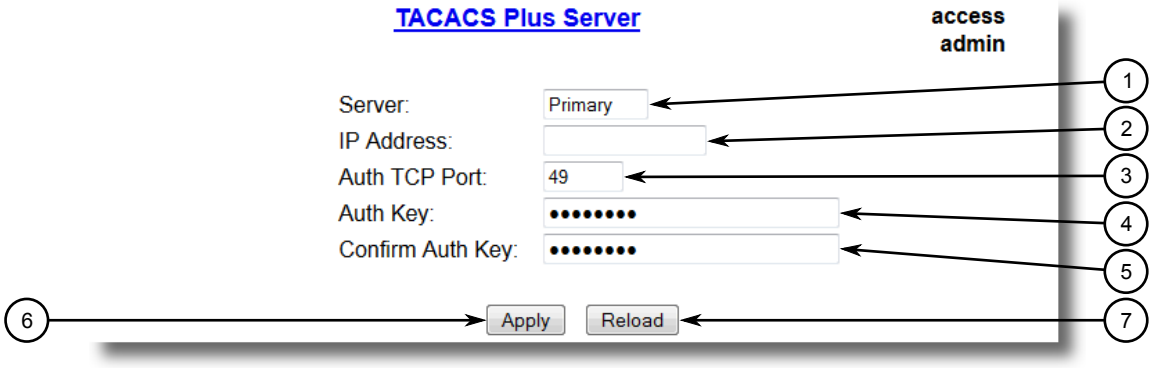


Figure 38: TACACS Plus Server Form

1. Server Box **2.** IP Address Box **3.** Auth TCP Port Box **4.** Auth Key Box **5.** Confirm Key Box **6.** Apply Button **7.** Reload Button

3. Configure the following parameter(s) as required:

Parameter	Description
Server	**Synopsis:** Any 8 characters **Default:** Primary This field tells whether this configuration is for a Primary or a Backup Server.
IP Address	**Synopsis:** ###.###.###.### where ### ranges from 0 to 255 The Server IP Address.
Auth TCP Port	**Synopsis:** 1 to 65535 **Default:** 49 The IP Port on server.
Auth Key	**Synopsis:** 31 character ascii string **Default:** mySecret The authentication key to be shared with server.
Confirm Auth Key	**Synopsis:** 31 character ascii string The authentication key to be shared with server.

4. Set the privilege levels for each user type (i.e. admin, operator and guest). For more information, refer to Section 4.8.2.2, “Configuring User Privileges” .

5. Click **Apply**.

Section 4.8.2.2
Configuring User Privileges

Each TACACS+ authentication request includes a *priv_lvl* attribute that is used to grant access to the device. By default, the attribute uses the following ranges:

- *15* represents the *admin* access level
- *2–14* represents the *operator* access level
- *1* represents the *guest* access level

To configure the privilege levels for each user type, do the following:

1. Navigate to ***Administration » Configure Security Server » Configure TacPlus Server » Configure TACPLUS Serv Privilege Config***. The **TACPLUS Serv Privilege Config** form appears.

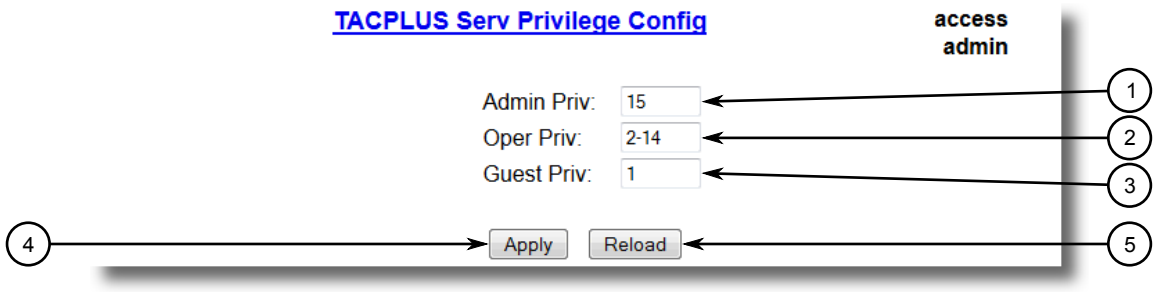


Figure 39: TACPLUS Serv Privilege Config Form

1. Admin Priv Box **2.** Oper Priv Box **3.** Guest Priv Box **4.** Apply Button **5.** Reload Button

2. Configure the following parameter(s) as required:

Parameter	Description
Admin Priv	**Synopsis:** (0 to 15)-(0 to 15) **Default:** 15 Privilege level to be assigned to the user.
Oper Priv	**Synopsis:** (0 to 15)-(0 to 15) **Default:** 2-14 Privilege level to be assigned to the user.
Guest Priv	**Synopsis:** (0 to 15)-(0 to 15) **Default:** 1 Privilege level to be assigned to the user.

3. Click **Apply**.

5 Setup and Configuration

This chapter describes how to setup and configure the device for use on a network using the various features available in RUGGEDCOM ROS.

CONTENTS

Section 5.1

Managing Time Services

The System Time Manager offers the following time-keeping and time synchronization features:

- Local hardware time keeping and time zone management
- SNTP (Simple Network Time Protocol) client and server
- IEEE 1588 master and slave (ordinary) clock modes of operation
- IRIG-B input (AM) and output (TTL/PWM)

CONTENTS

Section 5.1.1

Configuring the Time and Date

To set the time, date and other time-keeping related parameters, do the following:

1. Navigate to ***Administration » System Time Manager » Configure Time and Date***. The **Time and Date** form appears.

Figure 40: Time and Date Form

1. Time **2.** Date **3.** Time Zone **4.** DST Offset **5.** DST Rule **6.** Current UTC Offset Box **7.** Leap Second Pending Options **8.** Apply Button **9.** Reload Button

2. Configure the following parameter(s) as required:

Parameter	Description
Time	**Synopsis:** HH:MM:SS This parameter allows for both the viewing and setting of the local time.
Date	**Synopsis:** MMM DD, YYYY This parameter allows for both the viewing and setting of the local date.
Time Zone	**Synopsis:** { UTC-12:00 (Eniwetok, Kwajalein), UTC-11:00 (Midway Island, Samoa), UTC-10:00 (Hawaii), UTC-9:00 (Alaska), UTC-8:00 (Los Angeles, Vancouver), UTC-7:00 (Calgary, Denver), UTC-6:00 (Chicago, Mexico City), UTC-5:00 (New York, Toronto), UTC-4:30 (Caracas), UTC-4:00 (Santiago), UTC-3:30 (Newfoundland), UTC-3:00 (Brasilia, Buenos Aires), UTC-2:00 (Mid Atlantic), UTC-1:00 (Azores), UTC-0:00 (Lisbon, London), UTC+1:00 (Berlin, Paris, Rome), UTC+2:00 (Athens, Cairo, Helsinki), ... } **Default:** UTC-5:00 (New York, Toronto) This setting allows for the conversion of UTC (Universal Coordinated Time) to local time.
DST Offset	**Synopsis:** HH:MM:SS **Default:** 00:00:00 This parameter specifies the amount of time to be shifted forward/backward when DST begins and ends. For example for most part of USA and Canada, DST time shift is 1 hour (01:00:00) forward when DST begins and 1 hour backward when DST ends.
DST Rule	**Synopsis:** mm.n.d/HH:MM:SS mm.n.d/HH:MM:SS This parameter specifies a rule for time and date when the transition between Standard and Daylight Saving Time occurs. • mm - Month of the year (01 - January, 12 - December) • n - nth d-day in the month (1 - 1st d-day, 5 - 5th/last d-day) • d - day of the week (0 - Sunday, 6 - Saturday) • HH - hour of the day (0 - 24) • MM - minute of the hour (0 - 59) • SS - second of the minute (0 - 59) Example: The following rule applies in most part of USA and Canada:

Parameter	Description
	`03.2.0/02:00:00 11.1.0/02:00:00` DST begins on March's 2nd Sunday at 2:00am. DST ends on November's 1st Sunday at 2:00am.
Current UTC Offset	**Synopsis:** 0 to 1000 s **Default:** 36 s Coordinated Universal Time (UTC) is a time standard based on International Atomic Time (TAI) with leap seconds added at irregular intervals to compensate for the Earth's slowing rotation. Current UTC offset parameter allows user to adjust the difference between UTC and TAI. The International Earth Rotation and Reference System Service (IERS) observes the Earth's rotation and nearly six months in advance (January and July) a Bulletin-C message is sent out, which reports whether or not to add a leap second in the end of June and December. Please note that change in current UTC offset parameter will result in temporally disruption in the timing network.
Leap Second Pending	**Synopsis:** { No, Yes } **Default:** No This parameter allows user to manage the leap second event. A leap second is a second added to Coordinated Universal Time (UTC) in order to keep it synchronized with astronomical time. The International Earth Rotation and Reference System Service (IERS) observes the Earth's rotation and nearly six months in advance (January and July) a Bulletin-C message is sent out, which reports whether or not to add a leap second in the end of June and December. This parameter must set at least 5 minutes in advance before the occurrence of leap second event.

Section 5.1.2
Configuring IRIG-B

To configure IRIG-B, do the following:

1. Navigate to ***Administration » System Time Manager » Configure IRIGB***. The **IRIGB** form appears.

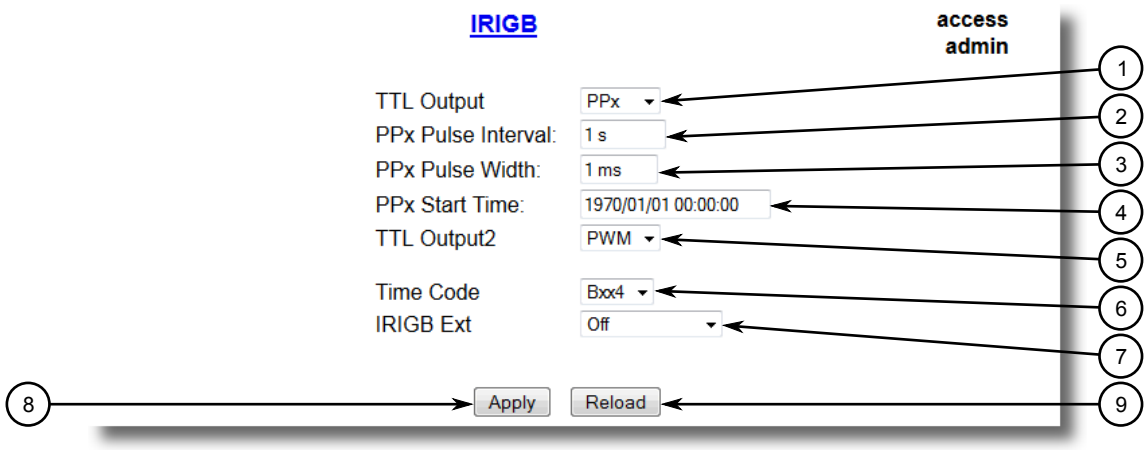


Figure 41: IRIGB Form – RMC8388A

1. TTL Output List **2.** PPx Pulse Interval List **3.** PPx Pulse Width List **4.** PPx Start Time List **5.** TTL Output2 List **6.** Time Code List **7.** IRIGB Ext List **8.** Apply Button **9.** Reload Button

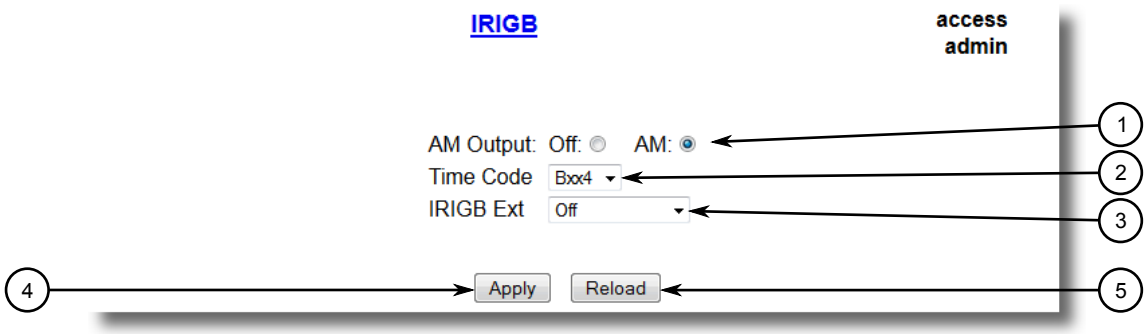


Figure 42: IRIGB Form – RMC8388B

1. AM Output Options **2.** Time Code List **3.** IRIGB Ext List **4.** Apply Button **5.** Reload Button

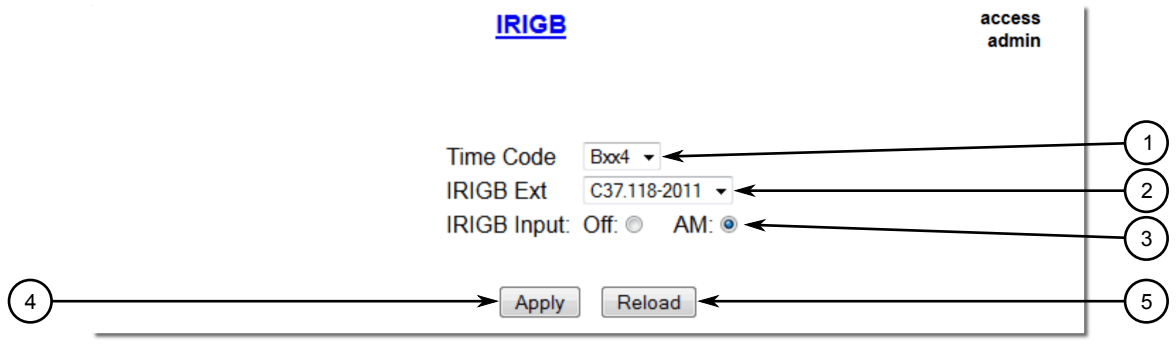


Figure 43: IRIGB Form – RMC8388C

1. Time Code List **2.** IRIGB Ext List **3.** IRIGB Input Options **4.** Apply Button **5.** Reload Button

2. Configure the following parameter(s) as required:

Parameter	Description
TTL Output	**Synopsis:** { Off, PWM, PPS, PPx } **Default:** PWM Selects Operational mode of TTL output port. PWM mode complies with IRIG Standard 200-04. PPx provides generic pulse per x second interface to synchronize external devices.
PPx Pulse Interval	**Synopsis:** 1 to 86400 s **Default:** 1 s Selects Pulse Interval for TTL output port. This parameter is used in conjunction with PPx in order to provides generic pulse per x second interface to synchronize external devices.
PPx Pulse Width	**Synopsis:** 1 to 200 ms **Default:** 1 ms Selects Pulse Width for TTL output port. This parameter is used in conjunction with PPx to control the width of the pulse.
PPx Start Time	**Synopsis:** YYYY/MM/DD HH:MM:SS **Default:** 1970/01/01 00:00:00 This parameter is used in conjunction with PPx to set the starting time of first PPx event. Note that this parameter must be set at least 15 seconds before the start of desired PPx otherwise first PPx event might be lost.
TTL Output2	**Synopsis:** { Off, PWM, PPS, PPx } **Default:** PWM Selects Operational mode of TTL output port. PWM mode complies with IRIG Standard 200-04. PPx provides generic pulse per x second interface to synchronize external devices.
AM Output	**Synopsis:** { Off, AM } **Default:** AM Selects AM (Amplitude Modulation) mode of IRIGB port. AM mode complies with IRIG Standard 200-04.
Time Code	**Synopsis:** { Bxx0, Bxx1, Bxx2, Bxx3, Bxx4, Bxx5, Bxx6, Bxx7 } **Default:** Bxx4 This device uses the following convention to decode the IRIGB time code: letter [B] represents IRIG-B format, and [xx] represents [00] for PWM/TTL mode of operation. For example, Bxx7 represents B007 for PWM/TTL operation. Please note that only Bxx0, Bxx1, Bxx4 and Bxx5 time codes support IRIGB extensions.

Parameter	Description
IRIGB Ext	**Synopsis:** { Off, IEEE1344, C37.118-2005, C37.118-2011 } **Default:** Off IRIGB extensions use extra bits of the Control Functions (CF) portion of the IRIGB time code. Within this portion of the time code, bits are designated for additional features, including: Calendar Year, Leap seconds, leap seconds pending, Daylight Saving Time (DST), DST pending, local time offset and time quality. Please note that only Bxx0, Bxx1, Bxx4 and Bxx5 time codes support IRIGB extensions.

3. Click **Apply**.
4. If **IRIGB Ext** was modified, reset the device. For more information, refer to Section 3.11, "Resetting the Device" .

Section 5.1.3

Managing the Precision Time Protocol (PTP)

The Precision Time Protocol (PTP) is a standard method of synchronizing network clocks over Ethernet. RUGGEDCOM ROS supports PTP v2, which is defined by the IEEE 1588 working group in the IEEE 1588-2008 standard.

PTP is a distributed protocol that allows multiple clocks in a network to synchronize with one another. These clocks are organized into a master-slave synchronization hierarchy with a *grandmaster* clock at the top of the hierarchy, which determines the reference time for the entire system. Synchronization is achieved via the exchange of PTP timing messages. *Slave* clocks use the timing information in PTP messages to adjust their time to that of the *master* in their part of the hierarchy.

The PTP protocol executes within a logical scope called a *domain*. The time established via the protocol within one domain is independent of the time in other domains.

A PTP v2 system may consist of a combination of both PTP-aware and PTP-unaware devices. There are five basic PTP device types defined in the IEEE 1588-2008 standard:

- Ordinary Clocks
- Boundary Clocks
- End-to-End Transparent Clocks
- Peer-to-Peer Transparent Clocks
- Management Nodes

RUGGEDCOM ROS supports *Ordinary Clock* mode. An Ordinary Clock can be either the grandmaster clock in a system or a slave clock in the master-slave hierarchy. The selection of grandmaster and slave clocks is based on the Best Master Clock (BMC) algorithm defined in the IEEE 1588-2008 standard.

CONTENTS

- Section 5.1.3.5, "Viewing Peer Delay Statistics"

Section 5.1.3.1
Configuring PTP Globally

To configure the global settings for PTP, do the following:

1. Navigate to ***Administration » System Time Manager » Precision Time Protocol » Configure Global Parameters***. The **Global Parameters** form appears.

> **IMPORTANT!**
> *Before performing SNMP get or SNMP set operations for MIBs IEEE C37.238-2011 and RUGGEDCOM-PTP1588-MIB.mib, make sure the PTP Enable parameter is set to **Yes**. For more information about supported MIBs, refer to Section 1.5, "SNMP Management Interface Base (MIB) Support".*

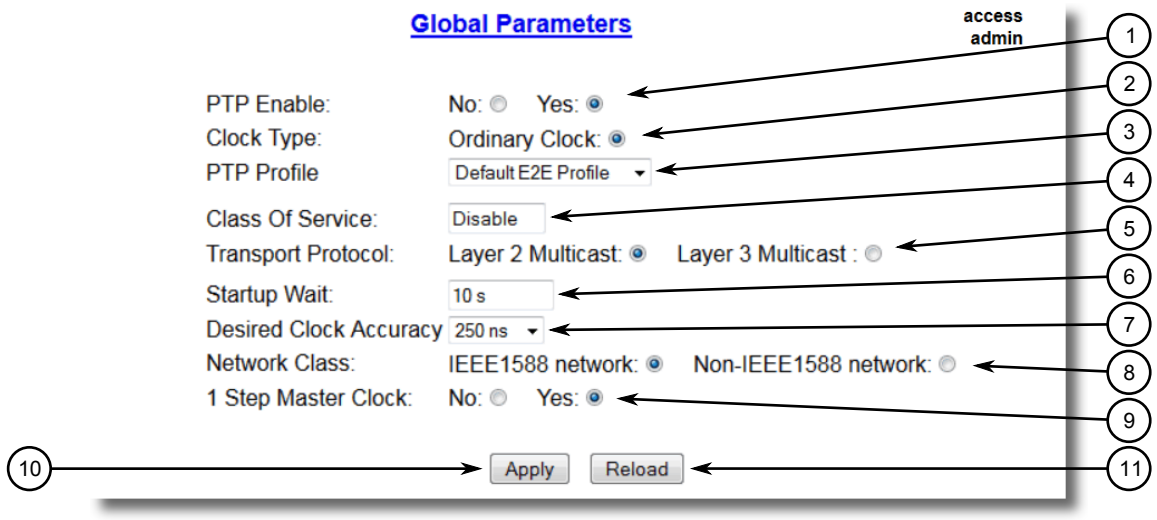


Figure 44: Global Parameters Form

1. PTP Enable Options **2.** Clock Type Options **3.** PTP Profile List **4.** Class Of Service Box **5.** Transport Protocol Options **6.** Startup Wait Box **7.** Desired Clock Accuracy List **8.** Network Class Options **9.** 1 Step Master Clock Options **10.** Apply Button **11.** Reload Button

2. Configure the following parameter(s) as required:

Parameter	Description
PTP Enable	**Synopsis:** { No, Yes } **Default:** No Enables PTP (Precision Time Protocol) protocol.
Clock Type	**Synopsis:** { Ordinary Clock } **Default:** Ordinary Clock Selects PTP (Precision Time Protocol) clock type. Note that this device only operates as a PTP Slave Clock.
PTP Profile	**Synopsis:** { Power Profile, Default P2P Profile, Utility Profile Level 1, Default E2E Profile, Custom Profile }

Parameter	Description
	Default: Power Profile Selects the PTP (Precision Time Protocol) clock profile. PTP profile represents a set of allowed PTP features applicable to specific industry. **NOTE** `Power Profile` *represents C37.238.2011.* **NOTE** `Utility Profile Level 1` *represents IEC/IEEE 61850-9-3 Ed.1.*
Class Of Service	**Synopsis:** 1 to 7 or { Disable } **Default:** 4 Selects the PTP (Precision Time Protocol) message priority based on the IEEE 802.1p specification. IEEE 802.1p defines eight different classes of service, usually expressed using the 3-bit priority field in an IEEE 802.1Q header added to the Ethernet frame.
Transport Protocol	**Synopsis:** { Layer 2 Multicast, Layer 3 Multicast } **Default:** Layer 2 Multicast Selects network transport protocol for PTP (Precision Time Protocol) messages.
Startup Wait	**Synopsis:** 0 to 3600 s **Default:** 10 s Normally the start-up time of a non-GPS master clock is less than that of a GPS-enabled master (i.e. by the time it takes to acquire GPS lock). This parameter provides the ability to bootstrap the PTP network in an orderly fashion.
Desired Clock Accuracy	**Synopsis:** { 50 ns, 100 ns, 250 ns, 1 us, 2.5 us, 10 us, 25 us, 100 us, 250 us, 1 ms, 2.5 ms, 10 ms, 25 ms, 100 ms, 250 ms } **Default:** 1 us This parameter allows the user to configure the desired clock accuracy. This represents the instantaneous value of the time offset between master and slave clocks. The system will generate an alarm if the time offset from the master exceeds the desired accuracy.
Network Class	**Synopsis:** { IEEE1588 network, Non-IEEE1588 network } **Default:** IEEE1588 network Clock servo stability is highly dependent on network personality. This parameter allows the user to configure a network personality to reflect a particular network environment. This might mean, for example, whether all devices in the timing plane are IEEE1588 aware (IEEE1588 network) or whether the timing plane includes non-IEEE1588 devices as well (non-IEEE1588 network). Note that a IEEE1588 network is independent of traffic load. Only the E2E mechanism is applicable to non-IEEE1588 networks.
1 Step Master Clock	**Synopsis:** { No, Yes } **Default:** Yes This parameter is specific to the Ordinary Clock type. It allows the user to configure 1-step or 2-step master clock functionality.

3. Click **Apply**.

Section 5.1.3.2
Configuring an Ordinary Clock

To configure settings for a PTP ordinary clock, do the following:

1. Navigate to ***Administration » System Time Manager » Precision Time Protocol » Configure Clock Parameters***. The **Clock Parameters** form appears.

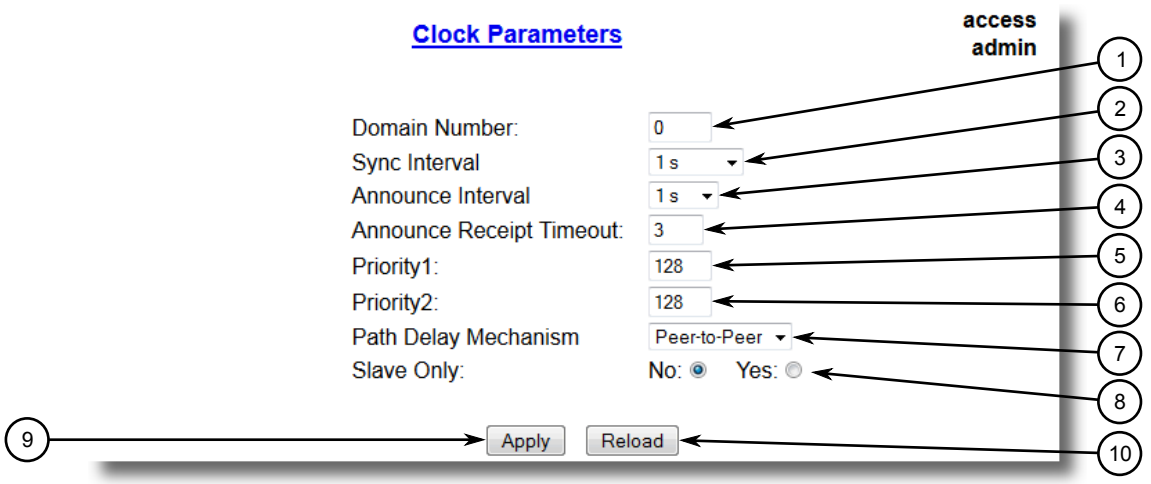


Figure 45: Clock Parameters Form

1. Domain Number Box **2.** Sync Interval List **3.** Announce Interval List **4.** Announce Receipt Timeout Box **5.** Priority 1 Box **6.** Priority 2 Box **7.** Path Delay Mechanism Options **8.** Slave Only Options **9.** Apply Button **10.** Reload Button

2. Configure the following parameter(s) as required:

Parameter	Description
Domain Number	**Synopsis:** 0 to 127 **Default:** 0 Selects the PTP (Precision Time Protocol) domain number. A PTP domain is a logical grouping of PTP clocks that synchronize to each other using the PTP protocol.
Sync Interval	**Synopsis:** { 125 ms, 250 ms, 500 ms, 1 s, 2 s } **Default:** 1 s Selects the PTP (Precision Time Protocol) Sync interval (mean time interval between successive Sync messages) in seconds. Sync messages are sent periodically by the Master Clock which provide time of day information to PTP Slave Clocks.
Announce Interval	**Synopsis:** { 1 s, 2 s, 4 s, 8 s, 16 s, 32 s } **Default:** 1 s Selects the PTP (Precision Time Protocol) Announce interval (mean time interval between successive Announce messages) in seconds. Announce messages are sent periodically by the Master Clock to provide its status and characteristic information. Announce messages are used to establish the synchronization hierarchy, i.e., using the BMC (Best Master Clock) algorithm.
Announce Receipt Timeout	**Synopsis:** 2 to 10 **Default:** 3 Selects the PTP (Precision Time Protocol) Announce receipt timeout. This parameter specifies the number of intervals that may pass without receipt of an Announce message. This parameter is part of BMC (Best Master Clock) algorithm. Please note that a change in this parameter may be disruptive.
Priority1	**Synopsis:** 0 to 255 **Default:** 128 Selects the PTP (Precision Time Protocol) clock priority1 during the execution of the BMC (Best Master Clock) algorithm. A lower value corresponds to a higher precedence. The

Parameter	Description
	BMC algorithm selects clocks from a set with a lower value of priority1 over clocks from a set with a greater value
Priority2	**Synopsis:** 0 to 255 **Default:** 128 Selects the PTP (Precision Time Protocol) clock priority2 during the execution of the BMC (Best Master Clock) algorithm. A lower value corresponds to a higher precedence. In the event that the operation of the BMC algorithm fails to order the clocks based on the values of priority1, clockClass, clockAccuracy and scaledOffsetLogVariance, the priority2 attribute allows the creation of up to 256 priorities to be evaluated before the tie-breaker. The tie-breaker is based on the clock identity.
Path Delay Mechanism	**Synopsis:** { Disabled, Peer-to-Peer, End-to-End } **Default:** Peer-to-Peer Selects the PTP (Precision Time Protocol) delay mechanism. There are two mechanisms used in PTP to measure the propagation delay between PTP ports: The P2P (Peer-to-Peer) delay mechanism measures the port to port propagation time such as link delay and frame residence time. The P2P mechanism is independent of whether the PTP port is acting as Master or Slave. The E2E (End-to-End) delay mechanism measures the message propagation time between Master and Slave clocks across the whole intervening network. Note that the P2P mechanism does not inter-operate with path delay measurements based on the E2E (also called request-response) delay mechanism.
Slave Only	**Synopsis:** { No, Yes } **Default:** Yes - RMC8388A,RMC8388B; No - RMC8388C This option may be used to force an Ordinary Clock be a Slave only clock. A slave only clock never enters the master state. Slave only and Transparent Clock functionality may be used in combination. Please note that a Boundary Clock must not be configured as a slave only clock.

3. Click **Apply**.

Section 5.1.3.3
Configuring the PTP Delay Request Interval

To configure the PTP delay request interval, do the following:

1. Navigate to ***Administration » System Time Manager » Precision Time Protocol » Configure Path Delay***. The **Path Delay** form appears.

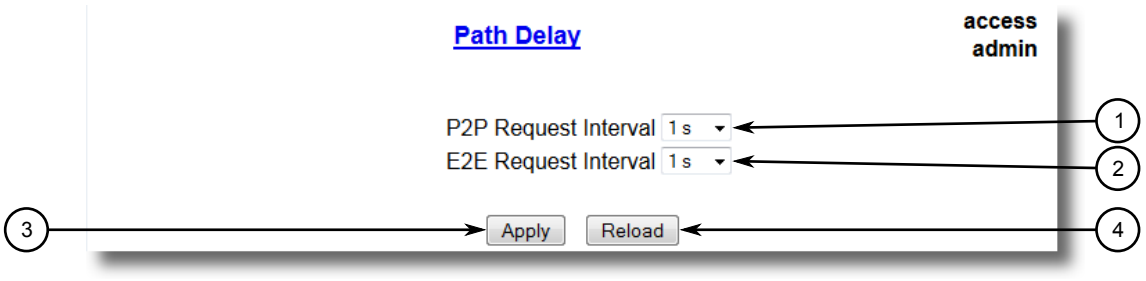


Figure 46: Path Delay Form

1. P2P Request Interval List **2.** E2E Request Interval List **3.** Apply Button **4.** Reload Button

2. Configure the following parameter(s) as required:

Parameter	Description
P2P Request Interval	**Synopsis:** { 1 s, 2 s, 4 s, 8 s, 16 s, 32 s } **Default:** 1 s Selects PTP delay request interval (mean time interval between successive delay request messages) in seconds. The peer delay mechanism measures the port-to-port propagation time, such as the link delay, between two communicating ports supporting the peer delay mechanism.
E2E Request Interval	**Synopsis:** { 1 s, 2 s, 4 s, 8 s, 16 s, 32 s } **Default:** 1 s Selects PTP delay request interval (mean time interval between successive delay request messages) in seconds. The E2E (also called request-response) delay mechanism measures the message propagation time between master and slave clocks.

3. Click **Apply**.

Section 5.1.3.4
Viewing PTP Clock Statistics

To view statistics for the Precision Time Protocol (PTP) clock, navigate to ***Administration » System Time Manager » Precision Time Protocol » View PTP Statistics » View PTP Clock Stats***. The **PTP Clock Stats** form appears.

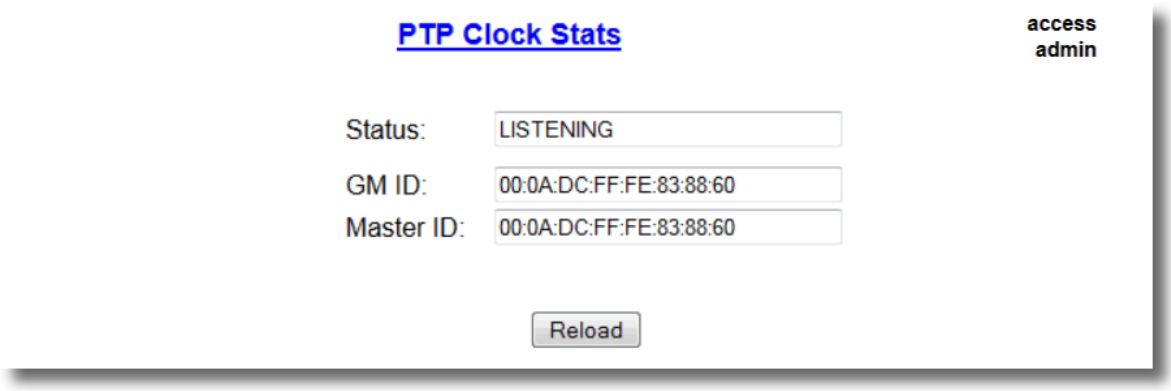


Figure 47: PTP Clock Stats Form (Example)

This form displays the following information:

NOTE
Parameters are available dependent on the status of the device.

Parameter	Description
Status	**Synopsis:** Any 31 Characters Shows the status of PTP (Precision Time Protocol) node, if device is configured as an ordinary clock then this field will show the status of the PTP state such as MASTER, SLAVE, LISTENING. If the device is configured as a Transparent Clock then this field simply reflects configuration setting.

Parameter	Description
GM ID	**Synopsis:** Any 31 Characters Shows the identity of PTP (Precision Time Protocol) grandmaster ID. Please note that master clock may be the same as grandmaster clock.
Master ID	**Synopsis:** Any 31 Characters Shows the identity of PTP (Precision Time Protocol) master clock. Please note that master clock may be the same as grandmaster clock.

Section 5.1.3.5
Viewing Peer Delay Statistics

To view statistics for the Precision Time Protocol (PTP) peer delay, do the following:

- Navigate to ***Administration » System Time Manager » Precision Time Protocol » View PTP Statistics » View Peer Delay Stats***. The **PTP Delay Stats** form appears.

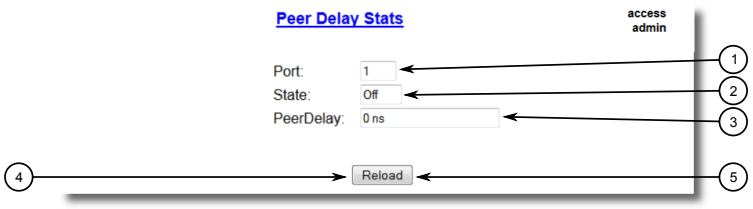


Figure 48: Peer Delay Stats Form

1. Port Box **2.** State Box **3.** Peer Delay Box **4.** Reload Button

This table displays the following information:

Parameter	Description
Port	**Synopsis:** 1 to 1 The port number as seen on the front plate silkscreen of the device.
State	**Synopsis:** { On, Off } Shows the status of PTP port with respect to P2P (Peer To Peer) delay mechanism.
PeerDelay	**Synopsis:** 0 to 2147483647 ns Shows peer delay in nanoseconds. The peer delay mechanism measures the port-to-port propagation time, such as the link delay, between two communicating ports supporting the peer delay mechanism.

Section 5.1.4
Configuring the Time Source

To configure a reference time source to be used by the device for the local clock and for all served time synchronization outputs, do the following:

1. Navigate to ***Administration » System Time Manager » Configure Time Source***. The **Time Source** form appears.

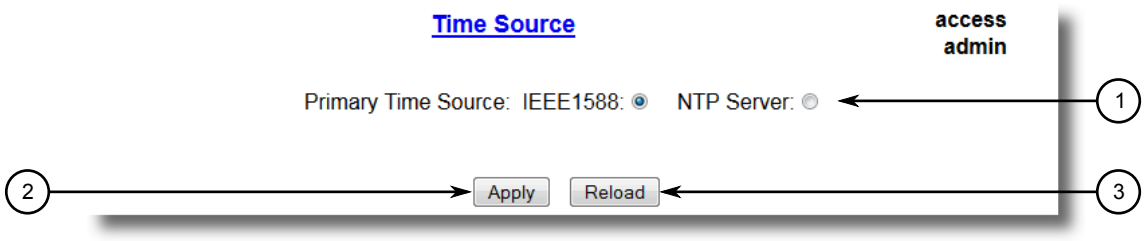


Figure 49: Time Source Form – RMC8388A and RMC8388B

1. Primary Time Source Options **2.** Apply Button **3.** Reload Button

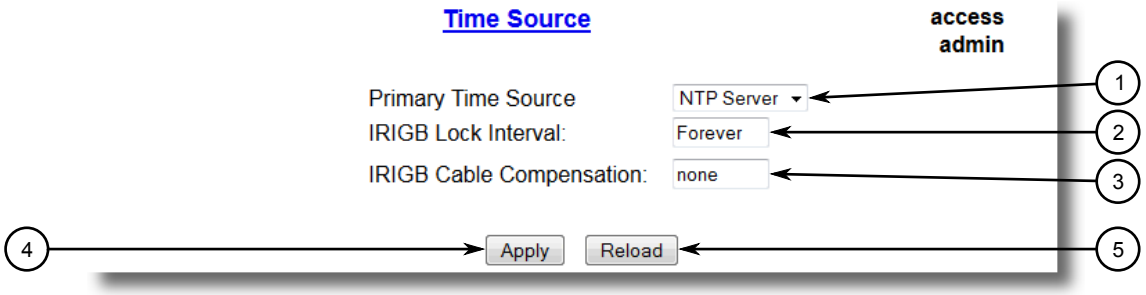


Figure 50: Time Source Form – RMC8388C

1. Primary Time Source Options **2.** Apply Button **3.** Reload Button

2. Configure the following parameter(s) as required:

Parameter	Description
Primary Time Source	**Synopsis:** { LOCAL CLK, IEEE1588, NTP Server, IRIGB } **Default:** LOCAL CLK To select time source that will discipline the local clock. Note that changing the time source may produce a step change in the time seen via any of the clock outputs.

3. Click **Apply**.

Section 5.1.5

Managing NTP

RUGGEDCOM ROS may be configured to refer periodically to a specified NTP server to correct any accumulated drift in the on-board clock. RUGGEDCOM ROS will also serve time via the Simple Network Time Protocol (SNTP) to hosts that request it.

Two NTP servers (primary and backup) may be configured for the device. The primary server is contacted first for each attempt to update the system time. If the primary server fails to respond, the backup server is contacted. If either the primary or backup server fails to respond, an alarm is raised.

CONTENTS

Section 5.1.5.1
Enabling/Disabling NTP Service

To enable or disable NTP Service, do the following:

1. **NOTE**
   If the device is running as an NTP server, NTP service must be enabled.

   Navigate to ***Administration » System Time Manager » Configure NTP » Configure NTP Service***. The **SNTP Parameters** form appears.

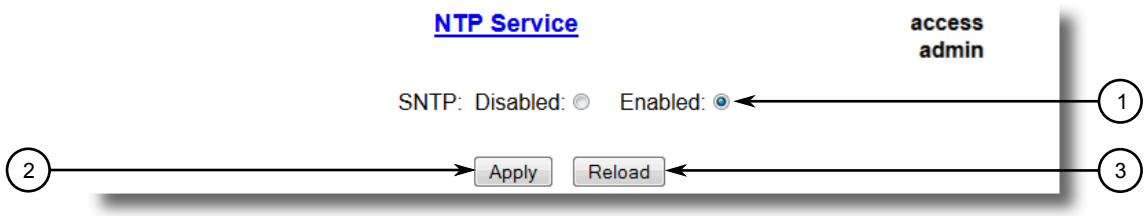


Figure 51: SNTP Parameters Form

1. SNTP Options **2.** Apply Button **3.** Reload Button

2. Select **Enabled** to enable SNTP, or select **Disabled** to disable SNTP.
3. Click **Apply**.

Section 5.1.5.2
Configuring NTP Servers

To configure either the primary or backup NTP server, do the following:

1. Navigate to ***Administration » System Time Manager » Configure NTP » Configure NTP Servers***. The **NTP Servers** table appears.

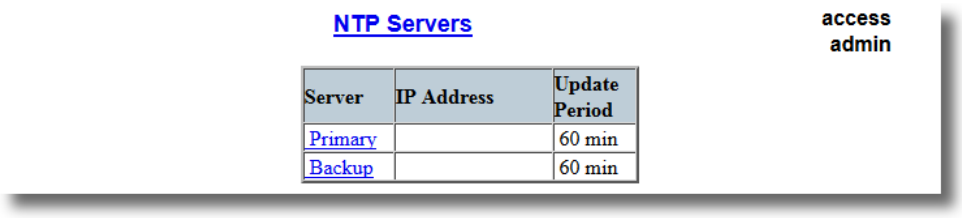


Figure 52: NTP Servers Table

2. Select either **Primary** or **Backup**. The **NTP Servers** form appears.

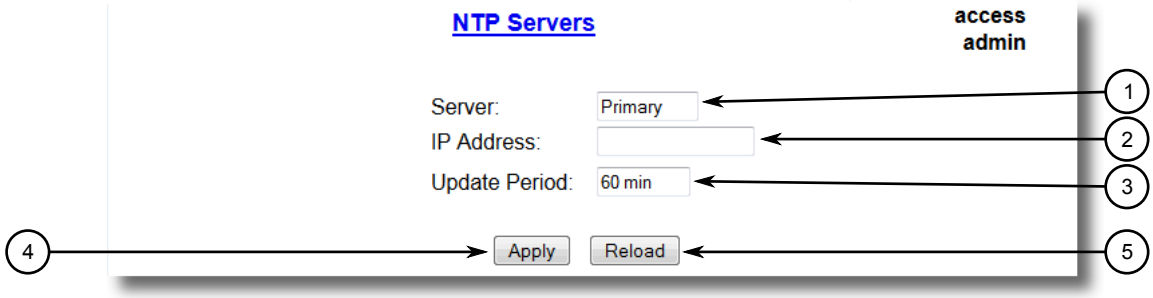


Figure 53: NTP Servers Form

1. Server Box **2.** IP Address Box **3.** Update Period Box **4.** Apply Button **5.** Reload Button

3. Configure the following parameter(s) as required:

Parameter	Description
Server	**Synopsis:** Any 8 characters **Default:** Primary This field tells whether this configuration is for a Primary or a Backup Server.
IP Address	**Synopsis:** ###.###.###.### where ### ranges from 0 to 255 The Server IP Address.
Update Period	**Synopsis:** 1 to 1440 min **Default:** 60 min Determines how frequently the (S)NTP server is polled for a time update.If the server cannot be reached in three attempts that are made at one minute intervals an alarm is generated.

4. Click **Apply**.

Section 5.1.6

Viewing the Status of Time Synchronization Subsystems

To view the current status of each time synchronization subsystem, navigate to ***Administration » System Time Manager » View Time Sync Status***. The **Time Sync Status** form appears. This form varies based on the time source configured.

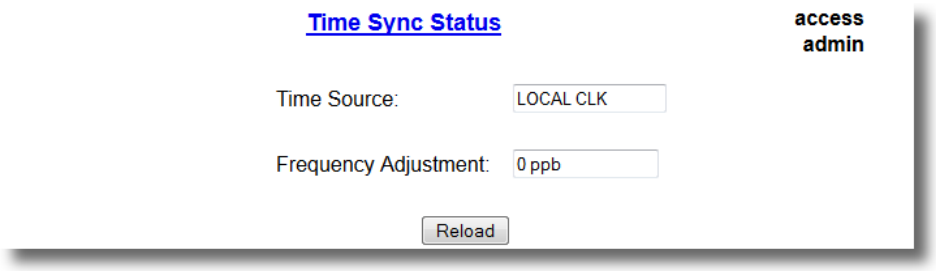


Figure 54: Time Sync Status Form (Local Time Source)

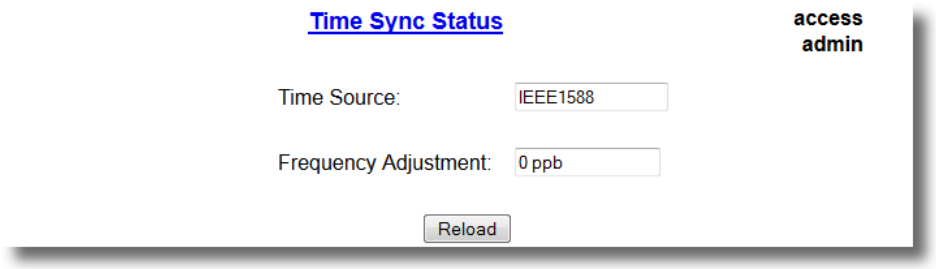


Figure 55: Time Sync Status Form (IEEE 1588 Time Source)

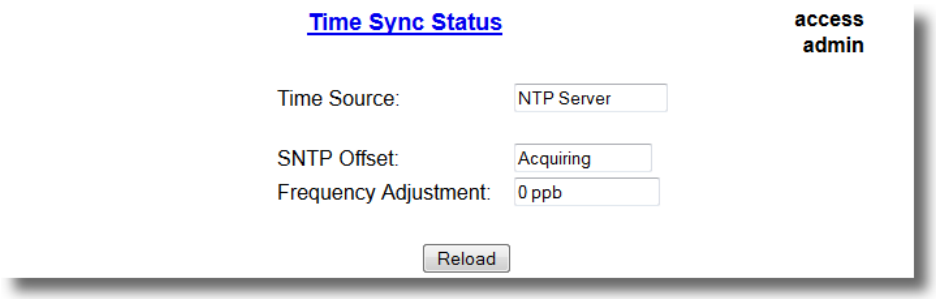


Figure 56: Time Sync Status Form (NTP Server Time Source)

This table displays the following information:

Parameter	Description
Time Source	**Synopsis:** { LOCAL CLK, NTP Server } A time source that is driving the local clock.
SNTP Offset	**Synopsis:** -2147483647 to 2147483646 us or { Acquiring, Holdover } Shows the current time offset between (S)NTP server and client clocks and is calculated as - .
Frequency Adjustment	**Synopsis:** -2147483647 to 2147483646 ppb Shows the current amount of discipline applied to the local frequency reference (TCXO); i.e. the amount of correction on this system required to synchronize to the current reference.

Section 5.2
Managing SNMP

RUGGEDCOM ROS supports versions 1, 2 and 3 of the Simple Network Management Protocol (SNMP), otherwise referred to as SNMPv1, SNMPv2c and SNMPv3 respectively. SNMPv3 provides secure access to the devices through a combination of authentication and packet encryption over the network. Security features for this protocol include:

Feature	Description
Message Integrity	Makes sure that a packet has not been tampered with in-transit.
Authentication	Determines if the message is from a valid source.
Encryption	Encrypts the contents of a packet to prevent it from being seen by an unauthorized source.

SNMPv3 provides security models and security levels. A security model is an authentication strategy setup for a user and the group in which the user resides. A security level is a permitted level of security within a security model. A combination of a security model and level will determine which security mechanism is employed when handling an SNMP packet.

Before configuring SNMPv3, note the following:

- Each user belongs to a group
- A group defines the access policy for a set of users
- An access policy defines what SNMP objects can be accessed for (i.e. reading, writing and creating notifications)
- A group determines the list of notifications its users can receive
- A group also defines the security model and security level for its users

For SNMPv1 and SNMPv2c, a community string can be configured. The string is mapped to the group and access level with a security name, which is configured as **User Name**.

CONTENTS

Section 5.2.1
Managing SNMP Users

This section describes how to manage SNMP users.

CONTENTS

- Section 5.2.1.3, "Deleting an SNMP User"

Section 5.2.1.1
Viewing a List of SNMP Users

To view a list of SNMP users configured on the device, navigate to ***Administration » Configure SNMP » Configure SNMP Users***. The **SNMP Users** table appears.

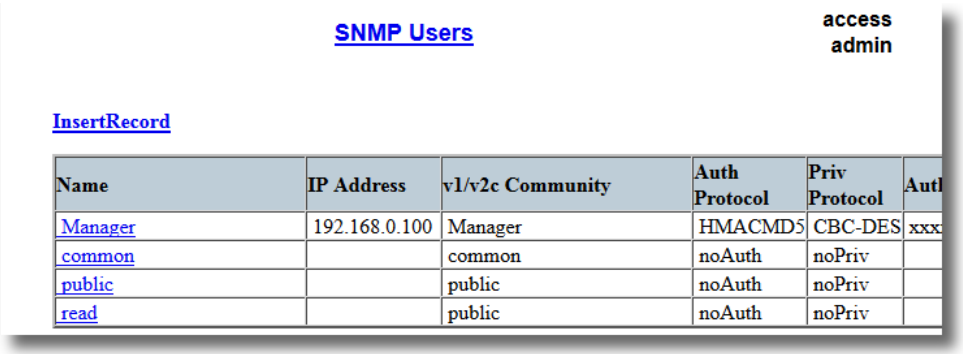


Figure 57: SNMP Users Table

If users have not been configured, add users as needed. For more information, refer to Section 5.2.1.2, "Adding an SNMP User" .

Section 5.2.1.2
Adding an SNMP User

Multiple users (up to a maximum of 32) can be configured for the local SNMPv3 engine, as well as SNMPv1 and SNMPv2c communities.

NOTE
*When employing the SNMPv1 or SNMPv2c security level, the **User Name** parameter maps the community name with the security group and access level.*

To add a new SNMP user, do the following:

1. Navigate to ***Administration » Configure SNMP » Configure SNMP Users***. The **SNMP Users** table appears.

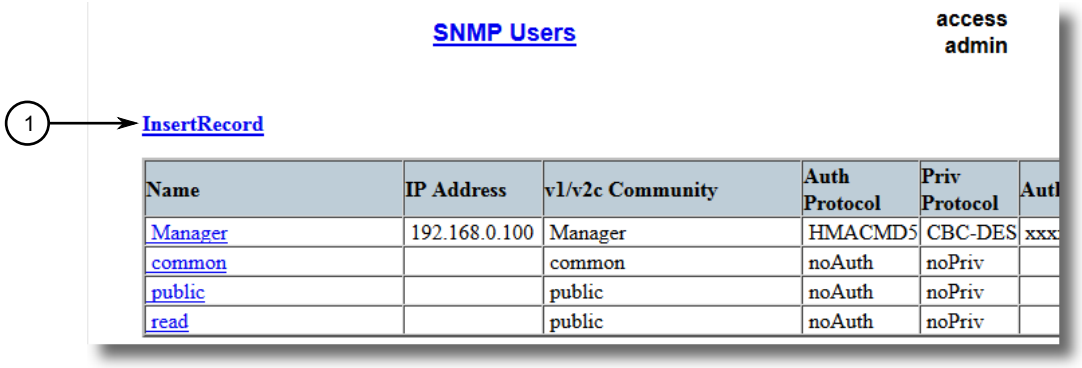


Figure 58: SNMP Users Table

1. InsertRecord

2. Click **InsertRecord**. The **SNMP Users** form appears.

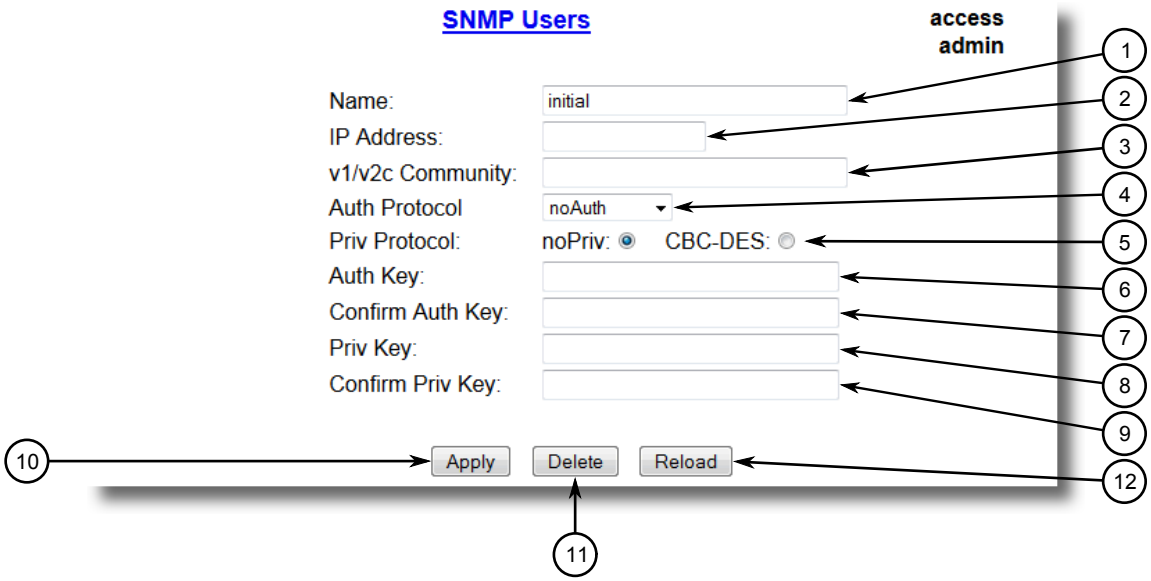


Figure 59: SNMP Users Form

1. Name Box **2.** IP Address Box **3.** v1/v2c Community Box **4.** Auth Protocol Box **5.** Priv Protocol Box **6.** Auth Key Box **7.** Confirm Auth Key Box **8.** Priv Key Box **9.** Confirm Priv Key Box **10.** Apply Button **11.** Delete Button **12.** Reload Button

NOTE

RUGGEDCOM ROS requires that all user passwords meet strict guidelines to prevent the use of weak passwords. When creating a new password, make sure it adheres to the following rules:

- *Must not be less than 6 characters in length.*
- *Must not include the username or any 4 continuous alphanumeric characters found in the username. For example, if the username is **Subnet25**, the password may not be **subnet25admin** or **subnetadmin**. However, **net25admin** or **Sub25admin** is permitted.*

- *Must have at least one alphabetic character and one number. Special characters are permitted.*
- *Must not have more than 3 continuously incrementing or decrementing numbers. For example,* ***Sub123*** *and* ***Sub19826*** *are permitted, but* ***Sub12345*** *is not.*

An alarm will generate if a weak password is configured. The weak password alarm can be disabled by the user. For more information about disabling alarms, refer to *Section 4.6, "Managing Alarms"* *.*

3. Configure the following parameter(s) as required:

Parameter	Description
Name	**Synopsis:** Any 32 characters **Default:** initial The name of the user. This user name also represents the security name that maps this user to the security group.
IP Address	**Synopsis:** ###.###.###.### where ### ranges from 0 to 255 The IP address of the user's SNMP management station. If IP address is configured, SNMP requests from that user will be verified by IP address as well. SNMP Authentication trap will be generated to trap receivers if request was received from this user, but from any other IP address.If IP address is empty, traps can not be generated to this user, but SNMP requests will be served for this user from any IP address.
v1/v2c Community	**Synopsis:** Any 32 characters The community string which is mapped by this user/security name to the security group if security model is SNMPv1 or SNMPv2c. If this string is left empty, it will be assumed to be equal to the same as user name.
Auth Protocol	**Synopsis:** { noAuth, HMACMD5, HMACSHA } **Default:** noAuth An indication of whether messages sent on behalf of this user to/from SNMP engine, can be authenticated, and if so, the type of authentication protocol which is used.
Priv Protocol	**Synopsis:** { noPriv, CBC-DES } **Default:** noPriv An Indication of whether messages sent on behalf of this user to/from SNMP engine can be protected from disclosure, and if so, the type of privacy protocol which is used.
Auth Key	**Synopsis:** 31 character ASCII string The secret authentication key (password) that must be shared with SNMP client. If the key is not an emtpy string, it must be at least 6 characters long.
Confirm Auth Key	**Synopsis:** 31 character ASCII string The secret authentication key (password) that must be shared with SNMP client. If the key is not an emtpy string, it must be at least 6 characters long.
Priv Key	**Synopsis:** 31 character ASCII string The secret encription key (password) that must be shared with SNMP client. If the key is not an emtpy string, it must be at least 6 characters long.
Confirm Priv Key	**Synopsis:** 31 character ASCII string The secret encription key (password) that must be shared with SNMP client. If the key is not an emtpy string, it must be at least 6 characters long.

4. Click **Apply**.

Section 5.2.1.3
Deleting an SNMP User

To delete an SNMP user, do the following:

1. Navigate to ***Administration » Configure SNMP » Configure SNMP Users***. The **SNMP Users** table appears.

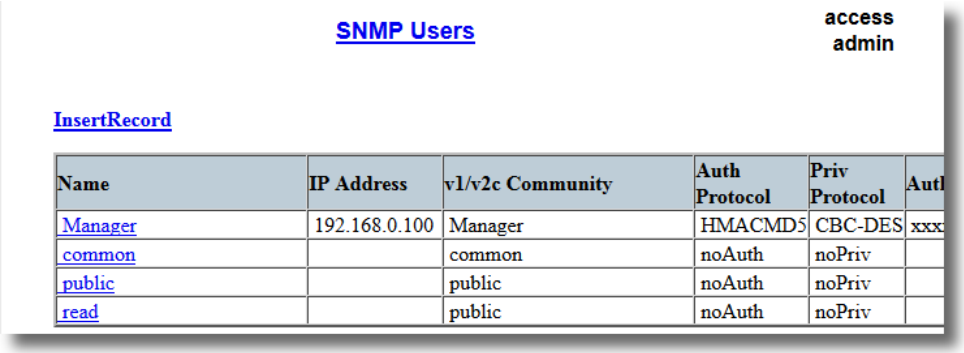


Figure 60: SNMP Users Table

2. Select the user from the table. The **SNMP Users** form appears.

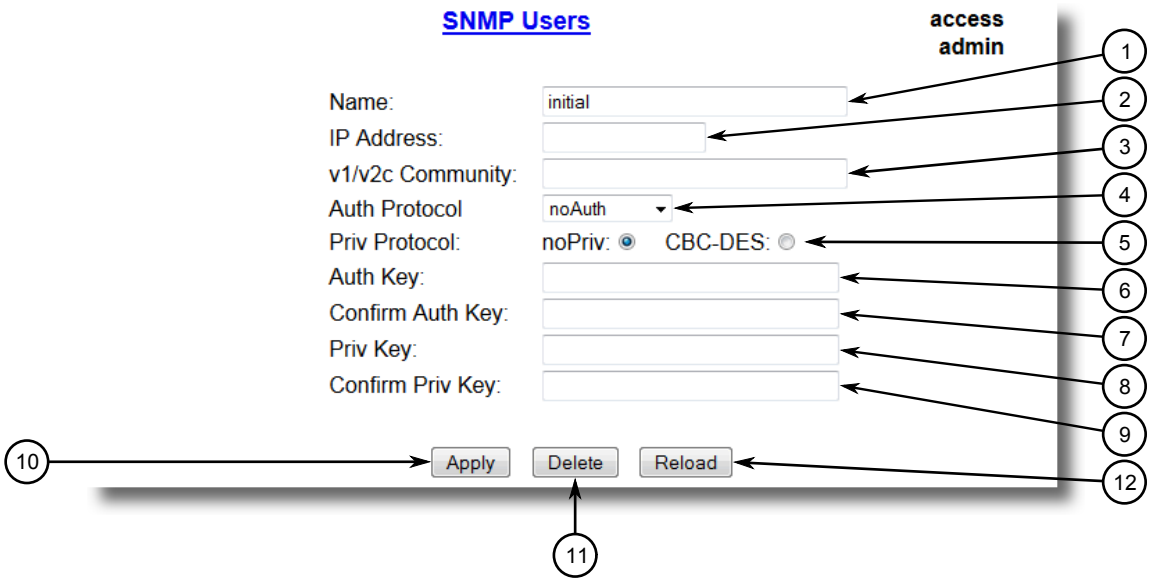


Figure 61: SNMP Users Form

1. Name Box **2.** IP Address Box **3.** v1/v2c Community Box **4.** Auth Protocol Box **5.** Priv Protocol Box **6.** Auth Key Box **7.** Confirm Auth Key Box **8.** Priv Key Box **9.** Confirm Priv Key Box **10.** Apply Button **11.** Delete Button **12.** Reload Button

3. Click **Delete**.

Section 5.2.2
Managing Security-to-Group Mapping

This section describes how to configure and manage security-to-group maps.

CONTENTS

Section 5.2.2.1
Viewing a List of Security-to-Group Maps

To view a list of security-to-group maps configured on the device, navigate to ***Administration » Configure SNMP » Configure SNMP Security to Group Maps***. The **SNMP Security to Group Maps** table appears.

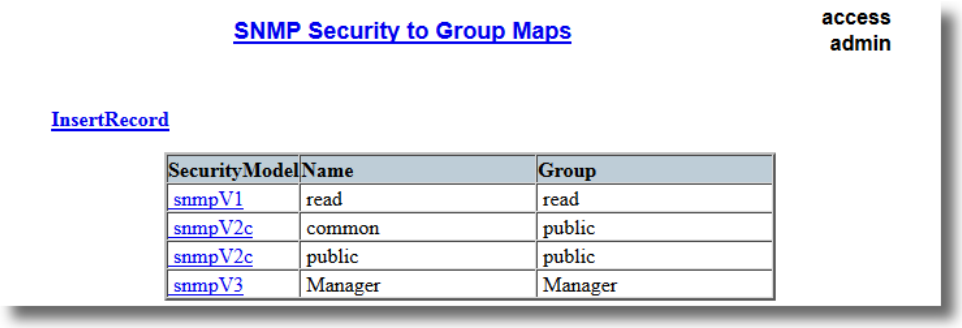


Figure 62: SNMP Security to Group Maps Table

If security-to-group maps have not been configured, add maps as needed. For more information, refer to Section 5.2.2.2, "Adding a Security-to-Group Map" .

Section 5.2.2.2
Adding a Security-to-Group Map

Multiple combinations of security models and groups can be mapped (up to a maximum of 32) for SNMP.

To add a security-to-group map, do the following:

1. Navigate to ***Administration » Configure SNMP » Configure SNMP Security to Group Maps***. The **SNMP Security to Group Maps** table appears.

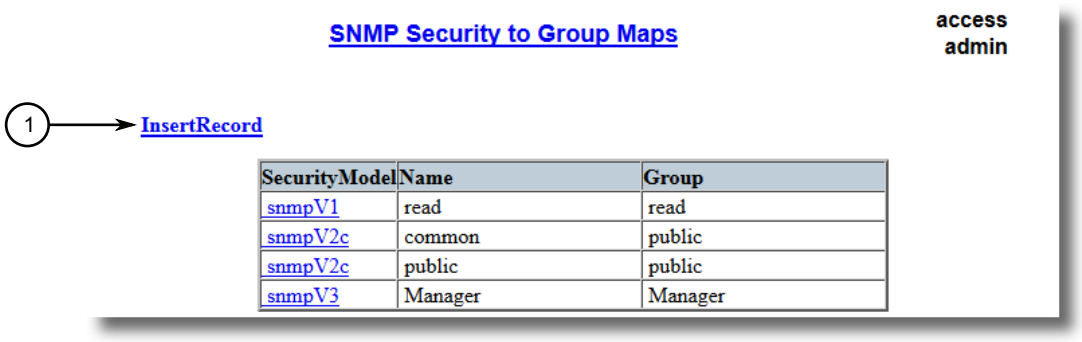


Figure 63: SNMP Security to Group Maps Table

1. InsertRecord

2. Click **InsertRecord**. The **SNMP Security to Group Maps** form appears.

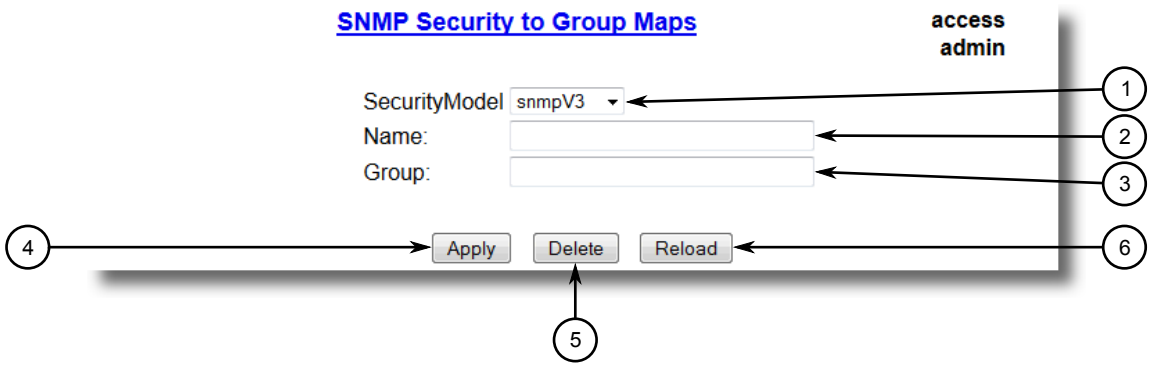


Figure 64: SNMP Security to Group Maps Form

1. Security Model Box **2.** Name Box **3.** Group Box **4.** Apply Button **5.** Delete Button **6.** Reload Button

3. Configure the following parameter(s) as required:

Parameter	Description
SecurityModel	**Synopsis:** { snmpV1, snmpV2c, snmpV3 } **Default:** snmpV3 The Security Model that provides the name referenced in this table.
Name	**Synopsis:** Any 32 characters The user name which is mapped by this entry to the specified group name.
Group	**Synopsis:** Any 32 characters The group name to which the security model and name belong. This name is used as an index to the SNMPv3 VACM Access Table.

4. Click **Apply**.

Section 5.2.2.3
Deleting a Security-to-Group Map

To delete a security-to-group map, do the following:

1. Navigate to ***Administration » Configure SNMP » Configure SNMP Security to Group Maps***. The **SNMP Security to Group Maps** table appears.

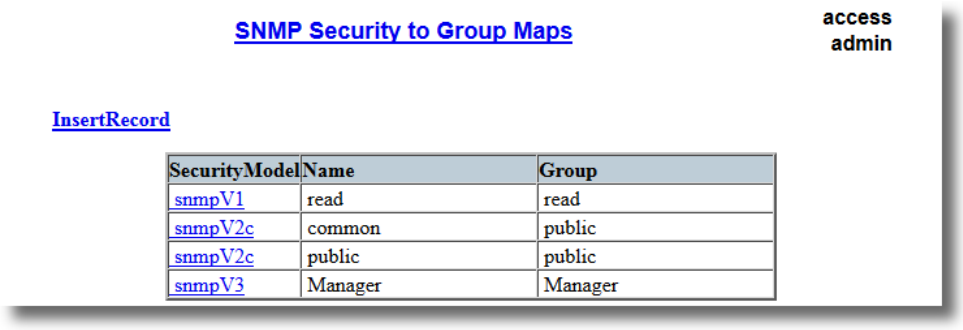


Figure 65: SNMP Security to Group Maps Table

2. Select the map from the table. The **SNMP Security to Group Maps** form appears.

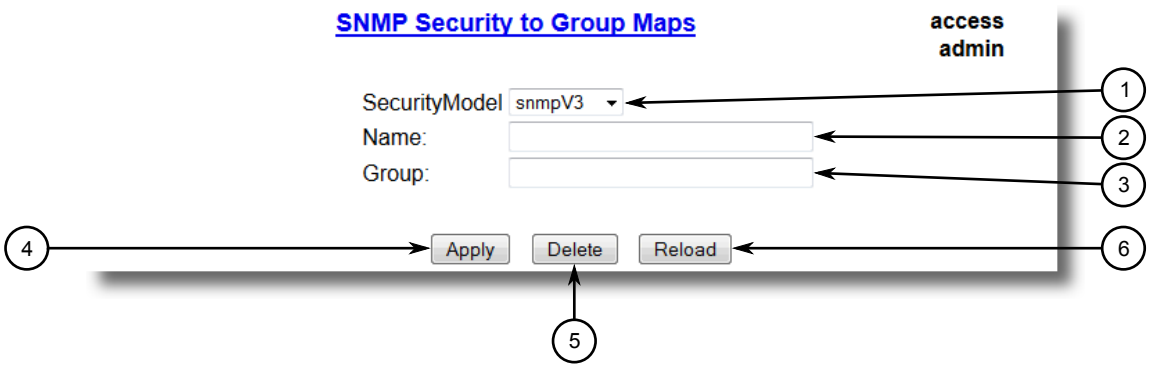


Figure 66: SNMP Security to Group Maps Form

1. Security Model Box **2.** Name Box **3.** Group Box **4.** Apply Button **5.** Delete Button **6.** Reload Button

3. Click **Delete**.

Section 5.2.3
Managing SNMP Groups

Multiple SNMP groups (up to a maximum of 32) can be configured to have access to SNMP.

CONTENTS

- Section 5.2.3.3, “Deleting an SNMP Group”

Section 5.2.3.1
Viewing a List of SNMP Groups

To view a list of SNMP groups configured on the device, navigate to ***Administration » Configure SNMP » Configure SNMP Access***. The **SNMP Access** table appears.

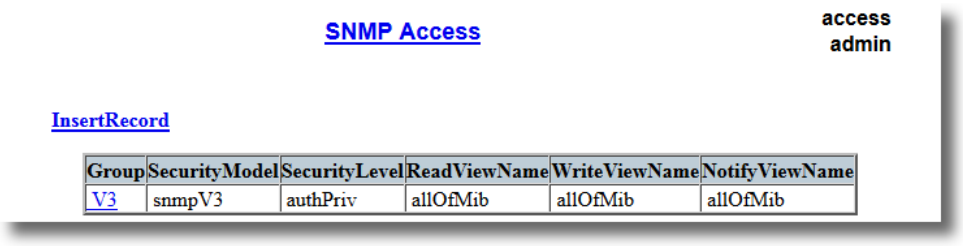


Figure 67: SNMP Access Table

If SNMP groups have not been configured, add groups as needed. For more information, refer to Section 5.2.3.2, “Adding an SNMP Group” .

Section 5.2.3.2
Adding an SNMP Group

To add an SNMP group, do the following:

1. Navigate to ***Administration » Configure SNMP » Configure SNMP Access***. The **SNMP Access** table appears.

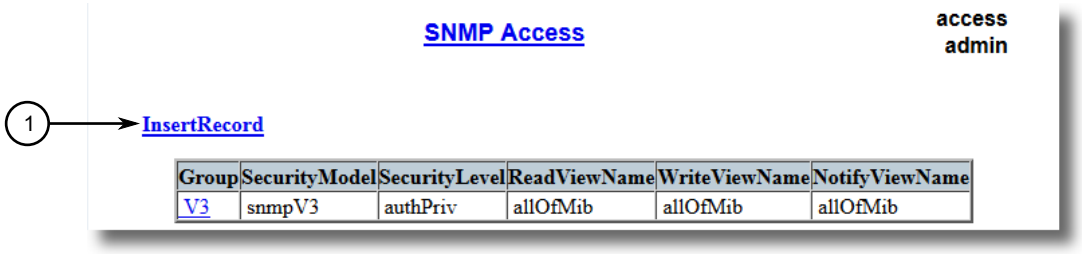


Figure 68: SNMP Access Table

1. InsertRecord

2. Click **InsertRecord**. The **SNMP Access** form appears.

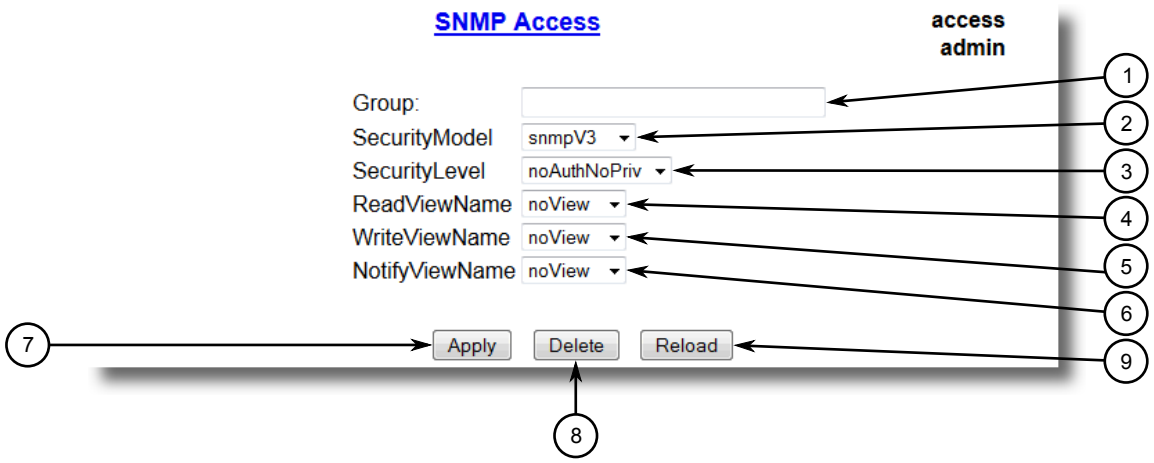


Figure 69: SNMP Access Form

1. Group Box **2.** Security Model Box **3.** Security Level Box **4.** ReadViewName Box **5.** WriteViewName Box **6.** NotifyViewName Box **7.** Apply Button **8.** Delete Button **9.** Reload Button

3. Configure the following parameter(s) as required:

Parameter	Description
Group	**Synopsis:** Any 32 characters The group name to which the security model and name belong. This name is used as an index to the SNMPv3 VACM Access Table.
SecurityModel	**Synopsis:** { snmpV1, snmpV2c, snmpV3 } **Default:** snmpV3 In order to gain the access rights allowed by this entry, configured security model must be in use.
SecurityLevel	**Synopsis:** { noAuthNoPriv, authNoPriv, authPriv } **Default:** noAuthNoPriv The minimum level of security reqwuired in order to gain the access rights allowed by this entry. A security level of noAuthNoPriv is less than authNoPriv, which is less than authPriv.
ReadViewName	**Synopsis:** { noView, V1Mib, allOfMib } **Default:** noView This parameter identifies the MIB tree(s) to which this entry authorizes read access. If the value is noView, then no read access is granted.
WriteViewName	**Synopsis:** { noView, V1Mib, allOfMib } **Default:** noView This parameter identifies the MIB tree(s) to which this entry authorizes write access. If the value is noView, then no write access is granted.
NotifyViewName	**Synopsis:** { noView, V1Mib, allOfMib } **Default:** noView This parameter identifies the MIB tree(s) to which this entry authorizes access for notifications. If the value is noView, then no access for notifications is granted.

4. Click **Apply**.

Section 5.2.3.3
Deleting an SNMP Group

To delete an SNMP group, do the following:

1. Navigate to ***Administration » Configure SNMP » Configure SNMP Access***. The **SNMP Access** table appears.

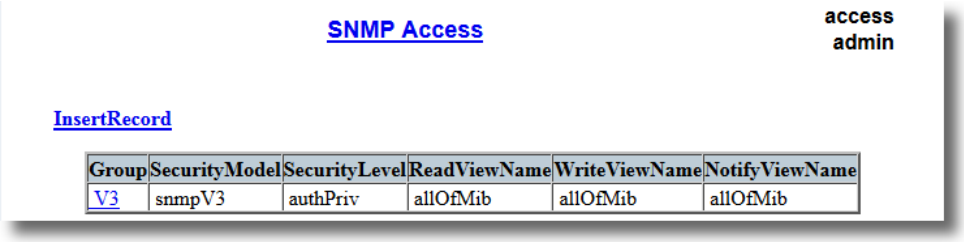


Figure 70: SNMP Access Table

2. Select the group from the table. The **SNMP Access** form appears.

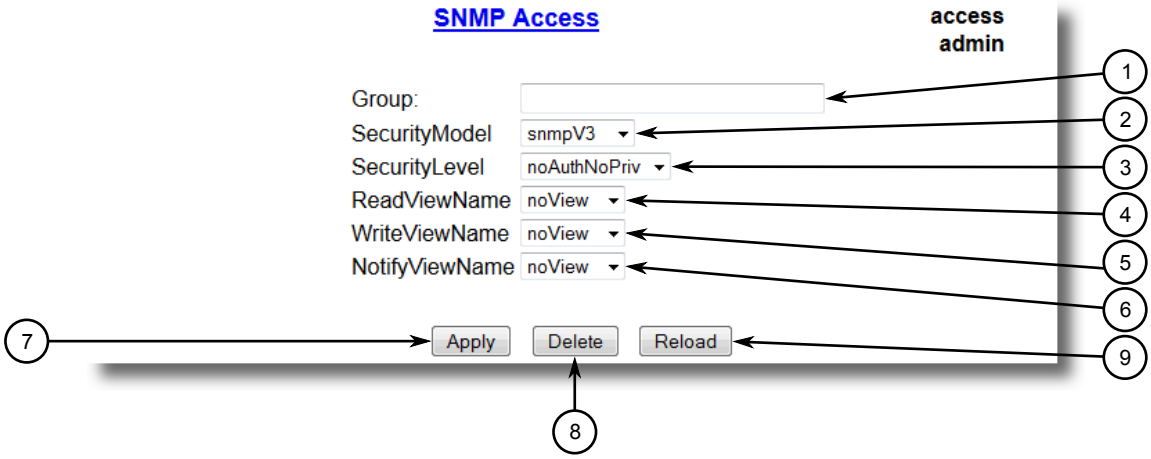


Figure 71: SNMP Access Form

1. Group Box **2.** Security Model Box **3.** Security Level Box **4.** ReadViewName Box **5.** WriteViewName Box **6.** NotifyViewName Box **7.** Apply Button **8.** Delete Button **9.** Reload Button

3. Click **Delete**.

Section 5.3
Managing Network Discovery

RUGGEDCOM ROS supports the RUGGEDCOM Discovery Protocol (RCDP), a Layer 2 protocol for automated network discovery.

RUGGEDCOM Discovery Protocol (RCDP) supports the deployment of RUGGEDCOM ROS-based devices that have not been configured since leaving the factory. RUGGEDCOM ROS devices that have not been configured all have the default IP (Layer 3) address. Connecting more than one of them on a Layer 2 network means that one cannot

use standard IP-based configuration tools to configure them. The behavior of IP-based mechanisms such as the web interface, SSH, telnet, or SNMP will all be undefined.

Since RCDP operates at Layer 2, it can be used to reliably and unambiguously address multiple devices even though they may share the same IP configuration.

Siemens's RUGGEDCOM Explorer is a lightweight, standalone Windows application that supports RCDP. It is capable of discovering, identifying and performing basic configuration of RUGGEDCOM ROS-based devices via RCDP. The features supported by RCDP include:

- Discovery of RUGGEDCOM ROS-based devices over a Layer 2 network.
- Retrieval of basic network configuration, RUGGEDCOM ROS version, order code, and serial number.
- Control of device LEDs for easy physical identification.
- Configuration of basic identification, networking, and authentication parameters.

For security reasons, RUGGEDCOM Explorer will attempt to disable RCDP on all devices when Explorer is shut down. If RUGGEDCOM Explorer is unable to disable RCDP on a device, RUGGEDCOM ROS will automatically disable RCDP after approximately one hour of inactivity.

NOTE
RCDP is not compatible with VLAN-based network configurations. For correct operation of RUGGEDCOM Explorer, no VLANs (tagged or untagged) must be configured. All VLAN configuration items must be at their default settings.

NOTE
RUGGEDCOM ROS responds to RCDP requests only. It does not under any circumstances initiate any RCDP-based communication.

6 Troubleshooting

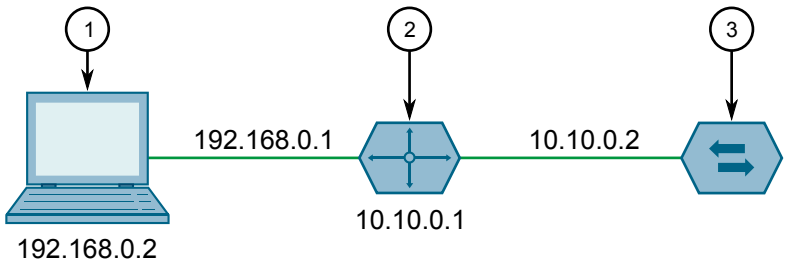
This chapter describes troubleshooting steps for common issues that may be encountered when using RUGGEDCOM ROS or designing a network.

IMPORTANT!
For further assistance, contact a Customer Service representative.

CONTENTS

Section 6.1
General

The following describes common problems.

Problem	Solution
The switch is not responding to ping attempts, even though the IP address and gateway have been configured. The switch is receiving the ping because the LEDs are flashing and the device statistics are logging the pings. What is going on?	Is the switch being pinged through a router? If so, the switch gateway address must be configured as well. The following figure illustrates the problem.  **Figure 72: Using a Router As a Gateway** **1.** Work Station **2.** Router **3.** Switch The router is configured with the appropriate IP subnets and will forward the ping from the workstation to the switch. When the switch responds, however, it will not know which of its interfaces to use to reach the workstation and will drop the response. Programming a gateway of 10.0.0.1 will cause the switch to forward unresolvable frames to the router. This problem will also occur if the gateway address is not configured and the switch tries to raise an SNMP trap to a host that is not on the local subnet.