

**SIEMENS**

# RUGGEDCOM Software

Network Management and Secure Access Management Solutions

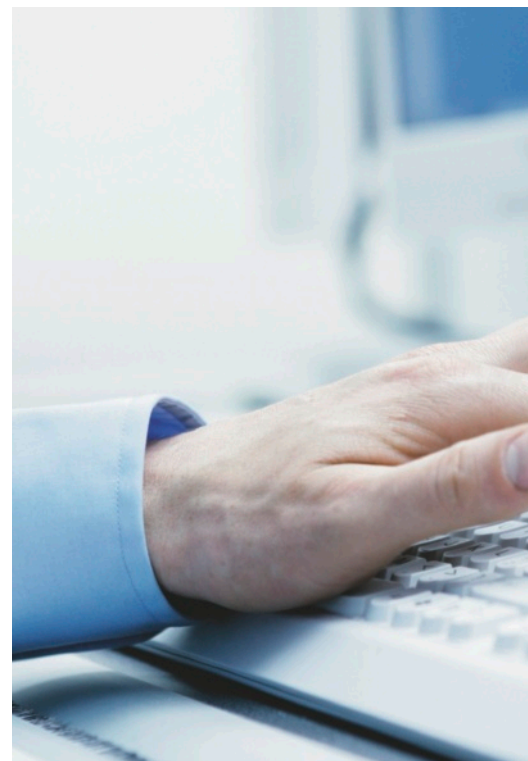
Brochure

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[siemens.com/ruggedcom-software](http://siemens.com/ruggedcom-software)

[www.ipc2u.de](http://www.ipc2u.de) [www.ipc2u.com](http://www.ipc2u.com)

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## RUGGEDCOM Software solutions

RUGGEDCOM Software solutions have been developed with our utility customers in mind to provide network management and tools, secure remote IED access, data conversion, routing, and visualization solutions. RUGGEDCOM Software is widely used in both field and enterprise environments and is developed and tested to ensure high reliability and robustness.

For installation guides and documentation for all RUGGEDCOM Software, visit Siemens Industry Online Support site (SIOS).

<http://support.industry.siemens.com>

# RUGGEDCOM CROSSBOW

## Secure Access Manager and Station Access Controller – application overview

**RUGGEDCOM CROSSBOW is a proven Secure Access Management solution designed to provide NERC CIP compliant access to Intelligent Electronic Devices.**

RUGGEDCOM CROSSBOW is a scalable solution tailored to the ever increasing industrial and utility asset owners needs. It provides cyber-secure local and remote user access to and management of all Intelligent Electronic Devices and their associated files. It is an enterprise class solution in compliance with the comprehensive and evolving US NERC CIP standard.

RUGGEDCOM CROSSBOW is a unique cyber security system designed to be simple, economical and intuitive enough to be operated by large numbers of personnel according to, and without inhibiting their normal duties. Users of the system could be from a diverse group of staff associated with:

- Asset condition monitoring
- Event response and investigation
- Maintenance (including vendors)
- Control, protection and telecommunications engineering

RUGGEDCOM CROSSBOW allows an Intelligent Electronic Device (IED) maintenance application to remotely communicate with its associated IEDs as if the users were directly connected to the device. RUGGEDCOM CROSSBOW's client-server architecture is designed to allow a large utility to easily manage remote connectivity to its entire population of field IEDs. User access is role based, and the user is not provided with any device password or network topology detail. User access is governed by the appropriate authentication model (e.g. Active Directory, RSA SecurID) and all user activity is logged and reported per the NERC CIP specification.

When used in combination with the RUGGEDCOM CROSSBOW Station Access Controller for local substation access, the CROSSBOW system provides an integrated, comprehensive solution with a seamless configuration environment, ensuring IED connectivity and activity logging is maintained at the substation level, even if the connection to the central server is disabled.

In addition, RUGGEDCOM CROSSBOW allows extensive automation of common device management tasks, such as password changes, file retrieval, and configuration management. CROSSBOW functionality may be extended through scripts and plug-ins, allowing users to develop automated solutions to their unique requirements. CROSSBOW's client-server architecture is designed to allow a large utility to easily manage remote connectivity to its entire population of field IEDs.

Key features include:

- Vendor agnostic design that works with all common substation gateways and IEDs, allowing deployment without adding or upgrading substation devices;
- An intuitive, complete product solution for ease of use and configuration:
  - Competitive solutions rely more heavily on integrating multiple 3rd party technologies together, making deployment and maintenance more complicated;
- A scalable, extendable platform, including:
  - Password management of relays and gateway devices;
  - Firmware management of relays and gateway devices;
  - Device configuration management (e.g. relay settings);
  - Event file (e.g. fault/oscillography) retrieval, either on demand or automatically scheduled.
- Integrated file management facility allows utility staff to control and retrieve device related files:
  - Includes version control, check-in/check-out, access control, and reporting;
  - Includes management of files associated with electromechanical and non-communicating devices, which may otherwise have no means of file management.



A unique solution for local or emergency substation access, the RUGGEDCOM CROSSBOW Station Access Controller provides the same level of security at the substation by pushing CROSSBOW database updates out to the field. This unique offering runs natively on the Rugged Operating System on Linux (ROX), so no additional substation computers are required.

#### Benefits

- Meets NERC standards for cyber security
- Strong (2-factor) authentication
- Individual user accounts and privileges
- Audit log of activity
- WAN or dial-up access to remote devices

#### NERC CIP compliance

CROSSBOW has maintained a leadership position in the market and continues to evolve with the evolution of the standard as the first commercially available application for addressing NERC CIP compliance. When combined with RUGGEDCOM routers and multi-service platforms, CROSSBOW offers one of the only completely integrated solutions for the substation:

- One-click compliance reports
- Following the CIP requirements set out for access control and change management
- User activity (key stroke) logging

#### Ease of administration

- Administration interface allows management of thousands of IEDs and hundreds of users
- Structured view of IEDs (region/substation/gateway)
- Grouping of devices and users
- Configurable sub-admins

#### Flexible architecture

- Client-server or “clientless” architecture using virtual desktops
- Available redundancy
- Dial-up or WAN access

#### Broad device support

Preserves investment in legacy gateway devices and communication infrastructure

- Siemens RUGGEDCOM routers and switches
- Siemens SIPROTEC
- Garrettcom
- SEL
- GE
- ABB
- Novatech
- Cooper
- RFL
- Industrial Defender
- Many other IEDs

## Secure Access Manager and Station Access Controller – system overview

### **RUGGEDCOM CROSSBOW Secure Access Manager (SAM)**

The RUGGEDCOM CROSSBOW Secure Access Manager runs on an enterprise grade Windows server platform, either on dedicated hardware or a virtual machine. When a RUGGEDCOM CROSSBOW client initiates a connection from its maintenance application to a remote device's maintenance interface, it contacts the CROSSBOW SAM server. The RUGGEDCOM CROSSBOW SAM server verifies the authenticity of the user, either through a personal user name and password login (basic security), or through interaction with a corporate security system (strong authentication), in order to establish the Role Based Access Control (RBAC) permissions.

After verification, the SAM allows the logged-in user to view all devices available to the user. When a device is selected for connection, the RUGGEDCOM CROSSBOW SAM server establishes a communication path to the device, either directly or through one or more remote gateways. The RBAC is configured during installation to control individual users and user groups to have varying arrangements of read/write access to IEDs, which can be controlled by region/facility/IED or even command level. The strong authentication option allows for integration of the user identification and permissions to be linked to the corporate system such as Active Directory, RSA SecurID or a RADIUS server.

### **RUGGEDCOM CROSSBOW Station Access Controller (SAC)**

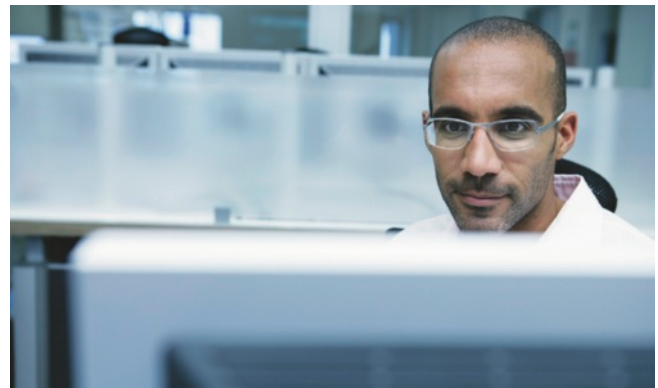
RUGGEDCOM CROSSBOW provides local and emergency connectivity through its optional Station Access Controller, which can be installed at the local or substation level. The RUGGEDCOM CROSSBOW SAC provides the same level of command control and logging when a user is physically present in the station, even when there is loss of communication path between the central SAM and the remote site. The RUGGEDCOM CROSSBOW SAC is completely synchronized with the RUGGEDCOM CROSSBOW SAM server. The SAC may run directly on ROX (e.g. on a RUGGEDCOM RX1100/1500/5000), or on the RUGGEDCOM RX1500 APE module.

### **Enterprise integration**

Typically, most customers of RUGGEDCOM CROSSBOW will have their own enterprise security components such as Active Directory, RSA, or RADIUS, as well as SQL databases. RUGGEDCOM CROSSBOW can integrate and make use of these components for authentication. The use of an SQL server is required by the CROSSBOW server to store its database. It is recommended that the utility makes use of its enterprise SQL servers to host this database, as often the enterprise will have its own backup and redundancy systems in place.

### **System architecture**

The diagram on the right illustrates a typical utility architecture using RUGGEDCOM CROSSBOW. The RUGGEDCOM CROSSBOW Secure Access Manager (SAM) is the central enterprise server through which all remote connections are made, and is the only trusted client source for the IEDs. This is the heart of the system, providing user role-based access control, site and IED access management. RUGGEDCOM CROSSBOW clients connect to the SAM via secure SSL connections to provide user access to remote IEDs. The SAM is connected over a secure WAN to substation gateway devices, such as RUGGEDCOM RX1500, or other supported device. The gateway connects to IEDs either directly or through downstream RTUs.



RUGGEDCOM CROSSBOW SAM also connects through to IEDs with their own direct modem access, such as for pole top applications, meters or process control, condition monitoring IEDs, and other host computer/servers. This ability of CROSSBOW to provide secure RBAC remote access to any IED makes it an essential tool for any IED based application for:

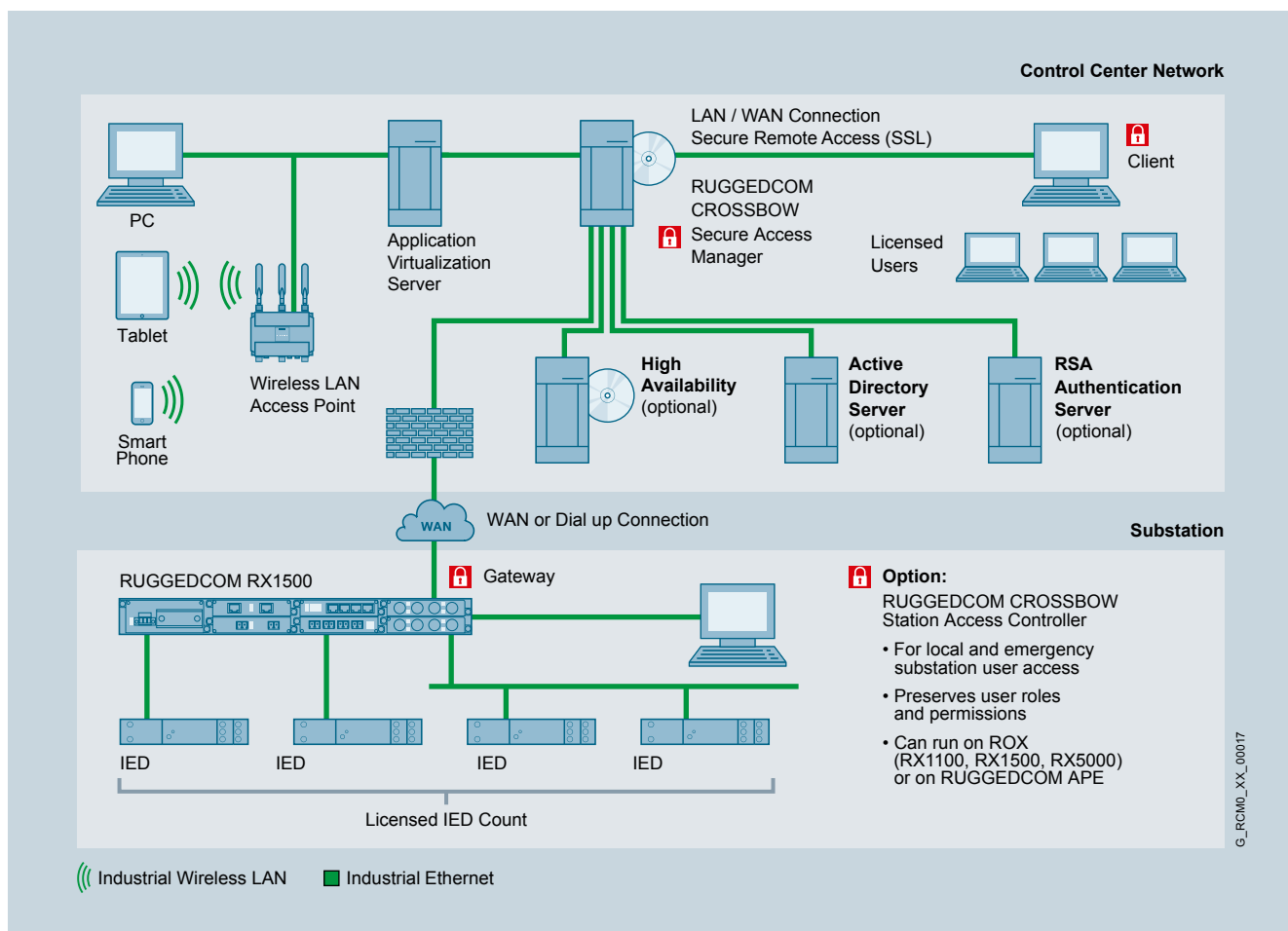
- Utilities (electricity, water, gas)
- Transport control systems
- Industrial and mining applications
- Building/site management systems

**Typical workflow**

RUGGEDCOM CROSSBOW is specifically designed to be intuitive and enhance users' normal activity. After logging in to the central SAM server, the user will be presented with a simple directory structure, displaying regions,

substations and devices, to which that user has been granted access to by the administrator.

From there, the user simply clicks on a chosen device to display a list of applications associated with the device. Selecting a program will instruct RUGGEDCOM CROSSBOW to launch the application and initiate a connection to the device – no need to negotiate connections, boot applications, or remember passwords. In most cases – just one click – the user is interacting directly with the device. Sophisticated password management functionality allows remote management of router, gateway, and IED passwords for supported devices.



RUGGEDCOM CROSSBOW system configuration



## Server requirements

RUGGEDCOM CROSSBOW server can run natively or in a virtual machine environment that meets the following requirements:

Component	Specification
CPU	x86 compatible, 2 GHz or faster
RAM	minimum 2 GB, 4+ GB recommended
Disk	50 GB
Operating system	Windows 2008 Server Windows 2008 Server R2 Windows 2012 Server *RUGGEDCOM CROSSBOW server components can run on 64-bit versions of the above operating systems

## Client requirements

Component	Specification
CPU	x86 compatible, 1 GHz or faster 2 GHz or faster recommended
RAM	minimum 1 GB
Disk	1 GB
Operating system	Windows Vista Windows 7 Windows 8 Windows 2008 Server Windows 2012 Server *RUGGEDCOM CROSSBOW client components can run on 64-bit versions of the above operating systems

## Core component options

### SAM server license

- RUGGEDCOM CROSSBOW SAM server software license
- RUGGEDCOM CROSSBOW SAM Quality Assurance (QA) testing server software license
- RUGGEDCOM CROSSBOW SAM high availability server software license

### IED licensing

Governs the maximum number of IEDs that can be configured in the RUGGEDCOM CROSSBOW system:

- Licensed in blocks of 100 IEDs

### User licensing

Governs the maximum number of users that can be configured in the RUGGEDCOM CROSSBOW system.

Users can be configured with either CROSSBOW basic authentication, or strong authentication (Active Directory, RSA, or RADIUS):

- Licensed in blocks of 5 users



## Optional components

### RUGGEDCOM CROSSBOW Application Modules (CAMs)

Governs which CAMs may be active on the system, and also how many IEDs the CAM may be active for. Each CAM is available in instance quantities equal to the IED licensing quantities:

- Firmware version CAM
- Configuration management CAM
- Connectivity CAM
- IED data retrieval CAM

### Station Access Controller (SAC)

Governs the maximum number of Station Access Controllers that may be configured in the RUGGEDCOM CROSSBOW system:

- Licensed equal to number of SACs required in system

### Event Log Distribution Service (ELDS)

The RUGGEDCOM CROSSBOW Event Log Distribution Service distributes event information gathered by CROSSBOW to other external event tracking systems. This service checks

for events on a user-defined schedule, and sends the events to a specified target. Supported targets for this service include the Windows event log (which can therefore support any third-party system that can monitor the Windows event log), Syslog and e-mail.

- Priced per target system interface (1-4 targets)

### Unattended Application Client (UAC)

The Unattended Application Client (UAC) is designed to act as an intermediary between the RUGGEDCOM CROSSBOW server and certain unattended applications, such as SEL 5040. The UAC emulates a modem to provide the application with its expected communication interface, but operations initiated by the application are routed through the UAC to the CROSSBOW server, so that they can be logged to assist with NERC compliance.

- Priced per client (1-4 clients)



# RUGGEDCOM ELAN

## Data concentration and protocol conversion

RUGGEDCOM ELAN solves a wide range of communications and data integration issues, from the substation to the control center and into the enterprise. The RUGGEDCOM ELAN family of products is based on the Linux operating system and includes the Substation Communications Server, Universal DNP Gateway, Remote Interface Gateway, and Front End Processor. Each product is focused on a specific application within the utility's

communication infrastructure. The central benefit of using RUGGEDCOM ELAN solutions is that a broad range of users within the utility are given secure access to the IED information that they require, made available in a format they understand, whenever they need it. When used with other RUGGEDCOM applications for secure remote access and data presentation and analysis, the user benefits from ease of integration and implementation.

The image displays two screenshots of the RUGGEDCOM ELAN web interface. The top screenshot shows the 'System Overview' page, which includes a table with the following data:

Server Name	RIG190	eLAN Version	RIG 8.02.02
Server Time	Wed May 1 2013 14:40:55 MDT	Uptime	48 days, 54 min
NTP Service	INACTIVE	Time Offset	.
Memory	888020 kB free / 1034408 kB total	Load Avgs	1 min:0.00, 5 min:0.01, 15 min:0.00

The bottom screenshot shows the 'eLAN Software' page, which includes a table of software components and their versions:

eLAN Product	Version
RIG Release	8.02.02
Protocol Router	8.02.03
DNP TCP Host	8.02.07
DNP SSL Host	8.02.07
DNP UDP Host	8.02.07
DNP SSL Client	8.02.07
IEC 104 TCP Host	8.02.07
eLAN TIE Core Runtime	8.02.03
TIE DNP Remote	8.02.03
TIE IEC 670-5-101/104 Remote	8.00.00
IECB70 101-104 Gateway	1.02.01
eLAN Web Interface	8.02.05

Additionally, the bottom screenshot shows a table of 'ELAN Remote Devices (RTU/IEDs)' with columns for Region, Device Name, RTU, Port, Status, Tx Messages, Rx Messages, Rx Errors, Rx Timeouts, and Consecutive Rx Timeouts. The table lists various devices across different regions like Distribution Sub, IED Faceplate, North, South east, Substation, and West.

A pop-up window titled 'Remote Device - IED Faceplate/Cooper CL88 - Mozilla Firefox' is also visible, showing a table of points with columns for Point Name, Point, Value, State, and Timestamp. The points listed include HMI\_Lower, VR\_ReductionActive, HMI\_NeutralPos, RegState, HMI\_Supply, BW\_High, HMI\_AutoOff, HMI\_Raise, TAPPING\_BLOCKED\_LED, User\_LED, and VR\_Reduction.

Sample screenshots of RUGGEDCOM ELAN web interface

RUGGEDCOM ELAN is an off-the-shelf solution to a wide range of applications and system requirements, including:

- Protocol conversion
- Data concentration
- Serial to Ethernet (TCP/IP or UDP/IP) conversion
- Device proxy server
- Poll acceleration
- Multi-master support
- Protocol Routing
- Encryption, using TLS/SSL

RUGGEDCOM ELAN is based on the robust, flexible Linux architecture, and is available on a variety of diskless hardware platforms and I/O configurations, including integration with the RUGGEDCOM RX1400 and RUGGEDCOM RX15xx ROX II family of devices and the RUGGEDCOM Application Processing Engine (APE). The Windows based RUGGEDCOM ELAN MAESTRO configuration tool allows rapid configuration and deployment of ELAN systems.

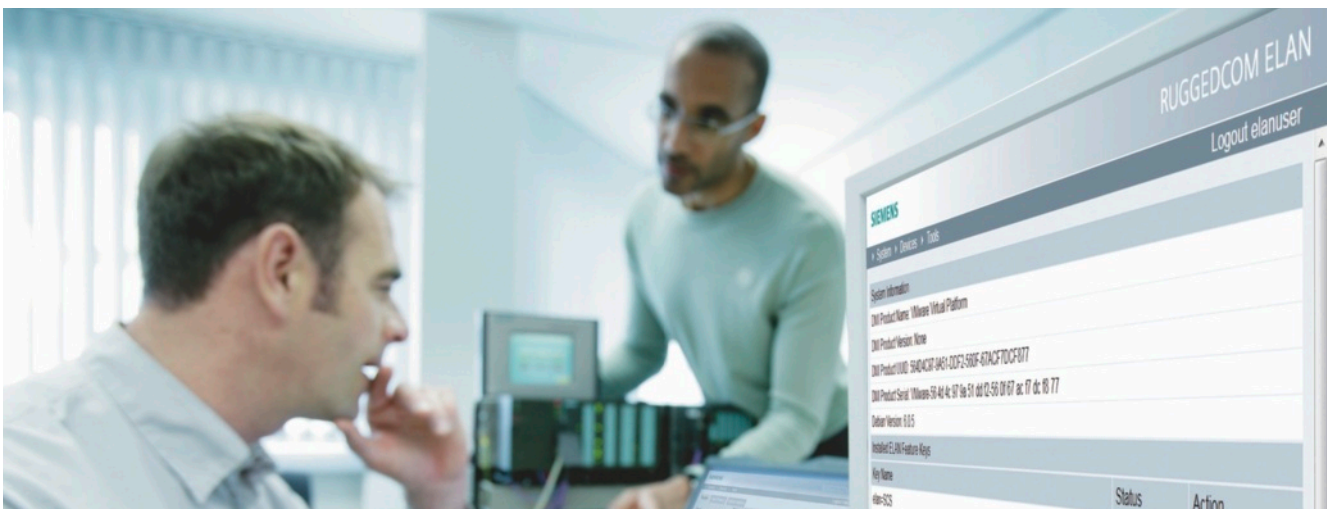
In addition to protocol conversion, RUGGEDCOM ELAN is also capable of protocol routing, which can be configured to provide the following functionality:

- Concurrent access: access to a single IED from multiple master stations
- Address masquerading: solves address contention issues
- Redundant host support: redundant hosts can eavesdrop to traffic to/from the primary host

### Built in Redundancy

RUGGEDCOM ELAN supports two modes of redundancy:

1. Communications path redundancy:  
in this mode two RUGGEDCOM ELANs are used to communicate with an end device. There is typically a PRIMARY path to the end device as well as a SECONDARY path. The RUGGEDCOM ELAN router can detect which route is active (connected or disconnected) and will forward messages from the master station to the end device via the appropriate channel. The two RUGGEDCOM ELAN servers communicate this pathing information to one another so each of them is aware of the available paths to the end device(s).
2. Substation/ELAN Gateway redundancy:  
in this mode the full substation communications gateway is redundant with two RUGGEDCOM ELAN servers. In this mode the two RUGGEDCOM ELAN servers communicate with one another to determine which one of them is the PRIMARY and which one is the SECONDARY/STANDBY. If the PRIMARY goes down, it will be detected by the SECONDARY, and all traffic will be switched and routed by the SECONDARY until the PRIMARY recovers.



## Universal Data Gateway

RUGGEDCOM ELAN UDG is the core of the ELAN application family created to address specific protocol conversion and translation issues related to RTUs, protection relays, PLCs, DFRs and other utility IEDs. Typical protocol support includes all of the following, along with lesser known formats:

- DNP3
- IEC-61850
- IEC 870-5-101
- IEC 870-5-104
- IEC 870-5-101 to 104 Gateway (Device level protocol conversion)
- Modbus

RUGGEDCOM ELAN UDG solves two common problems when deploying DNP 3.0:

1. Poll latency:  
placing an ELAN UDG between masters and high latency RTUs and IEDs allows data to be readily available during the polling cycle. This results in lower overall latency and better network utilization.
2. Multi-host support:  
multiple virtual instances of a given field device (a.k.a. Virtual RTU–VRTU) allow for multiple masters to independently communicate with them. The point map is preserved throughout to the master station. It is also possible to have multiple RTUs and IEDs mapped into a single VRTU, thus ELAN server acts as a data concentrator.

## Substation Communications Server

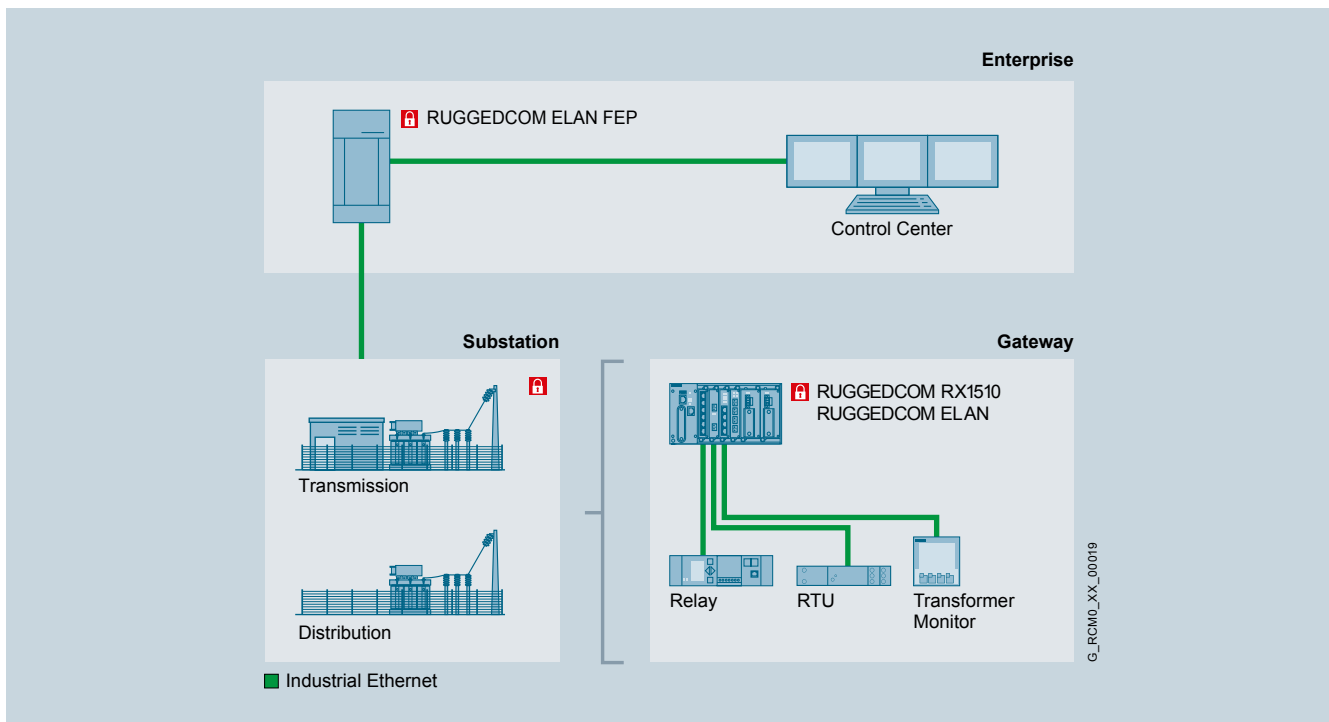
The RUGGEDCOM ELAN SCS typically resides in the substation and has direct connection to all IEDs. It provides a single point of access over a Wide Area Network (WAN), or modem connection (dial-up or leased line). The strength of the ELAN SCS lies in its ability to support multiple, concurrent host interfaces, each getting the specific data it needs.

For example, from a particular relay, SCADA data may be sent to the EMS using a SCADA protocol, a different subset of data may go to a historian, and fault files may be automatically extracted and distributed to interested users.

## Front End Processor

The RUGGEDCOM ELAN Front-End Processor is packaged to address the need to manage communications from remote sites, over a range of communications media. The RUGGEDCOM ELAN FEP provides protocol mediation capability in a vendor-neutral configuration, allowing users of a wide range of EMS systems to offload many of the tasks of managing communications with their field devices. RUGGEDCOM ELAN FEPs are frequently deployed to provide capabilities not available in native front ends, such as IP network support, security, or simply as a cost effective way to add additional ports.

The RUGGEDCOM ELAN FEP is based on the field-proven TIE (Telemetry Integration Environment) module, which was originally developed as the telemetry front end for a major EMS vendor and is currently installed in over 50 utilities worldwide.



RUGGEDCOM ELAN substation automation and integration





# RUGGEDCOM REFLEX

## Substation HMI, monitoring and control for distribution systems

RUGGEDCOM REFLEX Substation HMI is a purpose built solution for local and remote monitoring and controlling all aspects of substation operations. Whether you need support for users locally or remotely, RUGGEDCOM REFLEX makes information available through the following ready-to-deploy features:

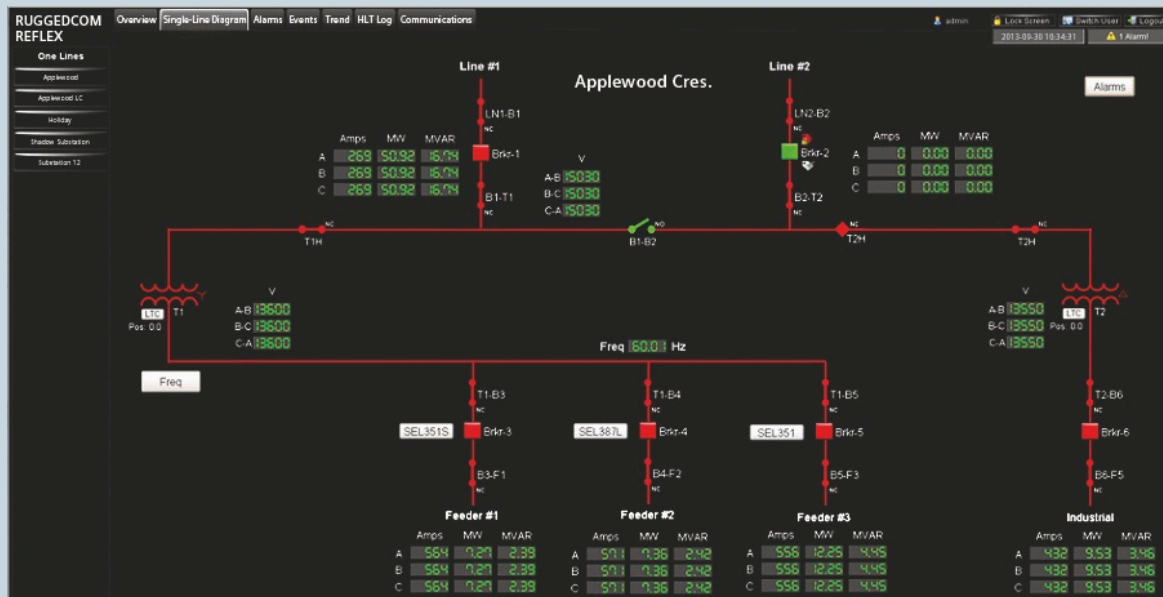
- Single Line diagram with rich graphics editor
- Multiple protocol support
- Faceplate emulation of many IEDs
- Alarm acknowledgement and summary
- Sequence of events summary
- Graphical trending of values
- Extensive reporting facility
- Historian option to record years of information

Custom screens and applications can also be quickly developed using the RUGGEDCOM REFLEX's advanced scripting language.

The RUGGEDCOM REFLEX device interface library is large, with more than 50 protocol interfaces that allow you to get to data from decades old RTUs as well as the latest 61850-based IEDs. RUGGEDCOM REFLEX can also be combined with the RUGGEDCOM ELAN Substation Communications Server to extend data visualization to include non-operational data and enhance reliability by partitioning the data acquisition and visualization functions.

### Network view

When you want to see the state of your substation network at a glance, RUGGEDCOM REFLEX provides a highly customizable view that can be panned and zoomed quickly. Drill down into device faceplate emulations or detailed data summaries, while keeping a view of the network in the background.



RUGGEDCOM REFLEX HMI and visualization

### Hot line tagging

RUGGEDCOM REFLEX allows a user to select any system point or device and tag it with information or inhibit controls to devices, such as a breakers or reclosers. A visual indicator on the single line diagram shows the operator at a glance which devices have hot line tags applied and will ensure that close commands cannot be given.

### Historical data logging

On occasion, real-time information isn't enough. For this reason, RUGGEDCOM REFLEX has an integrated historian feature using our open source database that allows users to tag data points for capture simply by checking a box. For most substation HMI applications this historian will grant rapid access to months and years of information.

### Rapid deployment

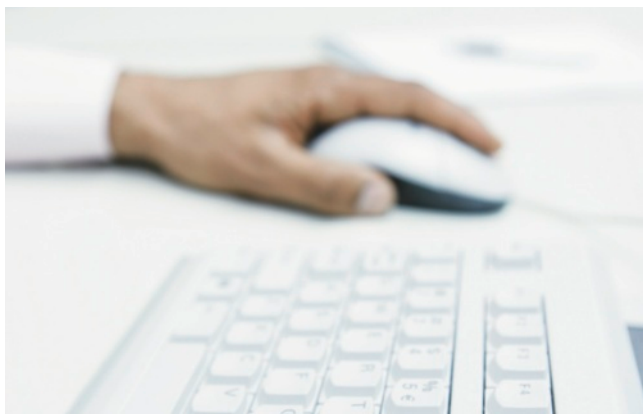
RUGGEDCOM REFLEX web and database-centric architecture allows for ultimate flexibility in getting projects developed quickly and cost effectively. Electric utility specific templates and graphic elements allow for rapid design and deployment. Many device types, such as commonly used relays, recloser controls, remote terminal units and power quality meters are supported out-of-the-box and are quickly configurable.

### Powerful graphics editor

Users can go beyond the standard graphic elements, such as breakers, buses, transformers and face plates to create their own customized view of the world. Drag and drop graphic elements and shapes as well as custom drawing tools are provided to allow for unlimited flexibility in tailoring your visibility.

### Scalability

RUGGEDCOM REFLEX is based on modern software architecture and systems: Java, web servers, databases and protocols. Combined with advanced features like load-balancing clustering and client re-targeting, its scalability is exceptional. From a single user HMI application to enterprise wide SCADA that spans service territories via corporate WANs to provide the base for a future Distribution Management System, REFLEX is designed to expand to virtually any customer's requirements.



**Security**

RUGGEDCOM REFLEX was built with security in mind from the ground up. Communication channels are encrypted using SSL technology. SCADA projects use advanced role-based authentication, and can integrate seamlessly with corporate network security using Microsoft Active Directory®.

**Logical data creation**

Users can manipulate actual data points to generate pseudo and logical data points using RUGGEDCOM REFLEX integrated logic engine functionality. Beyond data generation, users can implement automation schemes using the built in logic engine.

**Alarm view**

The purpose built alarm view gives users an immediate snapshot of all alarm states, with the ability to acknowledge and clear on a selected basis.

Alarms can be configured based on the following criteria:

- Binary change of state with the ability to customize alarm descriptions
- Analog dead bands with five severity levels
- Optionally send an e-mail or SMS text to a person or distribution list

**Event view**

The built-in sequence of events view uses our powerful data interface engine to generate a tabular, chronological view of event history regardless of device type. Binary state changes as well as logical data points moving out of range can be triggered to be included in either event or alarm views.

**Trending**

Virtually any point can be displayed in the trend view with the ability to quickly alter the view based on:

- Data source assignment
- Multiple pen colors
- Slide bar display for date and time ranges
- Pan and zoom
- Real-time or historical trending modes

**E-mail notification**

To enhance user awareness of critical system events, RUGGEDCOM REFLEX provides an easy to configure notification facility. E-mails or text messages can be generated to notify individual users or user groups of events of interest, including relevant data files if necessary.

**Cost effective client access**

With a web-launched client architecture customers don't have to choose only a select few to have the system on their computer. Any desktop, laptop or tablet capable of running Java or a web browser can have access to information.

**Mobility without boundaries**

RUGGEDCOM REFLEX web-launched architecture also makes it easier than ever to support field personnel who need to securely monitor and control devices. Our Java engine insures cross platform support (Windows, Linux, iOS, Android) and visibility on virtually every laptop, tablet or smart phone. No client software installation is required, just connect to the RUGGEDCOM REFLEX server like any other user.

**IT friendly**

RUGGEDCOM REFLEX is based entirely on modern, cross-platform technology, such as web (HTTP+SSL), SQL databases, and Java. This insures that your investment is not boxed in to a specific database or operating system.



# RUGGEDCOM NMS

Network Management software



The screenshot displays the RUGGEDCOM NMS interface. The top navigation bar includes links for Node List, Search, Outages, Path Outages, Dashboard, Events, Alarms, Notifications, Assets, Reports, Charts, Map, Network Monitor, Geographical Map, Admin, and Help. The main content area is divided into several sections:

- Home:** A summary box indicating "Nodes with Outages" and "There are no current outages".
- Percentage change over past 24 hours:** A table showing availability for various categories:
 

Categories	Outages	Availability
Network Interfaces	0 of 10	100.000%
Web Servers	0 of 10	100.000%
Email Servers	0 of 0	100.000%
DNS and DHCP Servers	0 of 0	100.000%
Database Servers	0 of 0	100.000%
JMX Servers	0 of 0	100.000%
Other Servers	0 of 0	100.000%
<b>Total</b>		
- Notification:** A box with "You: No outstanding notices (Check)" and "All: No outstanding notices (Check)", along with an "On-Call Schedule" link.
- Resource Graphs:** A dropdown menu labeled "-- Choose a node --".
- KSC Reports:** A link to "KSC Reports".

The bottom section shows the "Managed node information screen" for Node: ROX2-ROX000-06. It includes a "General" status section (Active), a "Notification" section (Outstanding/Acknowledged), and a "Recent Events" table:

Event ID	Time	Severity	Description
2240818	6/25/13 16:11:47	Normal	A services scan has been completed on this node.
2240721	6/25/13 15:54:59	Major	RUGGEDCOM If - ROX2 device Netconf configuration and state file download ERROR for ROX2:ROX000-06 172.30.128.240.
2240720	6/25/13 15:54:59	Major	RUGGEDCOM If - ROX2 device Netconf configuration download ERROR for ROX2:ROX000-06 172.30.128.240.
2240719	6/25/13 15:54:59	Major	RUGGEDCOM If - ROX2 YANG schema files download encountered ERROR.
2240687	6/25/13 15:49:45	Normal	A services scan has been completed on this node.

Below the events table are "Acknowledge", "Reset", and "More..." buttons. A "Recent Outages" section at the bottom states: "There have been no outages on this node in the last 24 hours."

The home page (top) shows the availability of all the nodes under management by RUGGEDCOM NMS. Managed node information screen (bottom) shows the node status, including services availability.

RUGGEDCOM NMS is scalable, fully-featured, enterprise grade software for monitoring, configuring and maintaining RUGGEDCOM mission-critical networks. It improves operational efficiency, speeds up system provisioning, and preserves data validity, while allowing focus on the key events on the network.

#### Product overview

- Centralized web based management of your RUGGEDCOM and IP-network
- Auto-discovery of device links and services and representation on a network map
- Real-time monitoring and notification of events, alarms and thresholds
- Continuous collection of traffic statistics for analysis and reporting
- Deployment of firmware/software upgrades across RUGGEDCOM devices
- Automatic backup of RUGGEDCOM device configuration data
- Creation of templates and propagation of configuration changes across ROX II devices
- Monitors Rugged Operating System (ROS) and ROX II configurations and reports changes that exceed the authorized user-defined boundaries
- Bulk password changes of ROS, ROX I based RUGGEDCOM devices, as well as RUGGEDCOM WIN products

### Automated network discovery and data polling

RUGGEDCOM NMS has a versatile polling engine configurable to meet customer needs. Devices are discovered using ICMP pings and upon RUGGEDCOM NMS receiving traps or logs from a device. Services are detected for devices supporting LLDP and a topology map is created. All discovered devices have their performance data regularly collected by the NMS polling system.

### Alarms and event management

RUGGEDCOM NMS continuously monitors the network and reports any changes or errors it detects. Events can originate outside RUGGEDCOM NMS, such as SNMP traps or syslog messages generated by devices under management. NMS can also generate events internally, such as upon the detection of a new device or when forcing a service scan of a device. Alarms are events that have been selected as being representative of the current health of the network.

Many alarms can be cleared by the system without operator intervention. For example, when an alarm posted for a broken network link subsequently receives an event indicating the network link has been reestablished, the alarm condition is then removed from the alarm List. RUGGEDCOM NMS users can quickly and intuitively create and manipulate complex filtering criteria for the list of events and alarms to display. It is also possible for events and logs received by RUGGEDCOM NMS to be forwarded to one or multiple destinations.

### Network performance monitoring and reporting

RUGGEDCOM NMS continuously collects traffic statistics for analysis and reporting. Reports allow a network operator to assess the current and historical health of the network. These reports provide the tools needed to pro-actively detect issues and correct them before an outage or unacceptable network latency occurs.

Through the Network Monitor feature, RUGGEDCOM NMS learns the traffic characteristics of all devices supporting RMON 2 on your network.

- Monitors network traffic for abnormal behavior such as a rapid rise or fall in throughput
- Triggers RUGGEDCOM NMS events and notifications on discovery of abnormal traffic conditions
- Automatically adjusts the monitoring baseline over time to account for natural increases in network traffic and allows users to define their own customized threshold rules

### Network mapping

RUGGEDCOM NMS provides powerful, flexible, browser-based mapping of network entities under NMS management. It can automatically map and lay out a selected set of devices, save and restore custom map views, perform live map updates, display map updates in real-time, and more.

- Icons specific to each device type
- Hierarchical and organic views
- Grouping of multiple objects under a single icon
- Color coded representation of each node and link status
- Graphical representation of the bandwidth used between ports
- Network monitor usage Gauge (for overall usage of network bandwidth)
- Drill down capability by clicking on desired devices icon and getting detailed information
- A geographical map is also available for display of RUGGEDCOM WIN base stations

### Management of RUGGEDCOM devices

RUGGEDCOM NMS is the perfect tool to perform the configuration management and maintenance of RUGGEDCOM devices running ROX, ROX II, ROS and WIN firmware. From a centralized platform, it is possible to perform a bulk update of device firmware. Configuration data is automatically backed up on the NMS server. NMS can also automatically change the password used on ROS and ROX I based RUGGEDCOM products, as well as RUGGEDCOM WIN products.

### Dynamic configuration

RUGGEDCOM NMS minimizes the time required when configuring ROX II based devices with the use of templates dynamically created from the data of an existing device. The dynamic configuration feature allows viewing, manipulating and comparing configuration data and distributing changes across multiple devices easily and efficiently.

### Firewall management

RUGGEDCOM NMS simplifies the deployment of firewall policies for RUGGEDCOM ROX II devices with an interface enabling to view policies configured and to efficiently deploy changes across multiple devices.





# RUGGEDCOM DIRECTOR

## Serial port redirector software

RUGGEDCOM DIRECTOR is a serial port redirection application that is designed to extend the life and reach of applications written for serial communications.

With RUGGEDCOM DIRECTOR, serial port communications are no longer limited by serial protocol cable length requirements or physical port counts that restrict the design and flexibility of networks and the ability to manage them.

Using RUGGEDCOM DIRECTOR, the application communications destined for host serial ports are mapped to the host LAN ports for transport across a TCP/IP network to RUGGEDCOM serial servers. This allows the host to be located centrally for easier management and maintenance and provides access to many more serial devices. The redirection is done seamlessly and with no modification required to the host application.

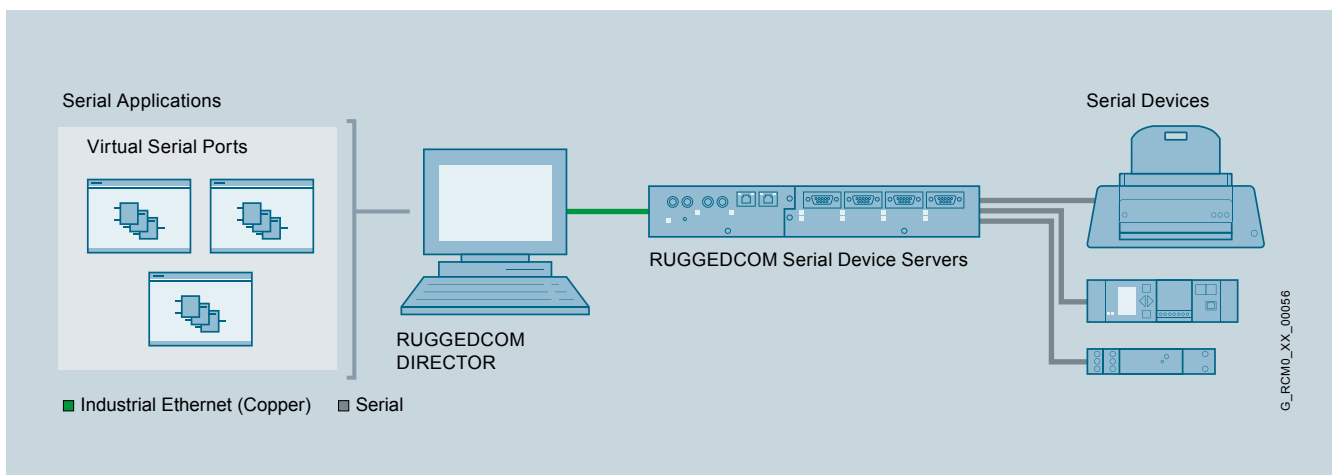
Getting up and running quickly is easy with the Windows based graphical user interface. Simply provide the port parameters on the application host and the RUGGEDCOM serial server and RUGGEDCOM DIRECTOR automatically generate the required connections.

The main interface window shows the connected ports, status and the number of packets sent and received providing real-time information on the health of system.

Troubleshooting is simplified with the logging feature of RUGGEDCOM DIRECTOR; the data flow on a selected port can be monitored in the detail dialogue window and directed to a file for further analysis. RUGGEDCOM DIRECTOR saves time and cost allowing legacy serial devices and applications to communicate over LAN connections without modification to hardware or software. RUGGEDCOM DIRECTOR is a complimentary software package designed to work with RUGGEDCOM serial device servers.

## System requirements

Component	Specification
Operating System	Windows XP SP3 Windows 7 Windows 8



RUGGEDCOM DIRECTOR

# RUGGEDCOM EXPLORER

## RUGGEDCOM ROS device discovery and configuration software

RUGGEDCOM EXPLORER is a powerful tool to easily provision and configure new and existing ROS based devices. Its built-in file transfer capabilities allow users to easily upload and download files and firmware from one convenient console.

### Features

- Discover and configure new and existing RUGGEDCOM ROS devices on your LAN
- Intuitive GUI interface displays all ROS devices and visually identifies duplicate IP addresses
- Auto configuration capabilities on groups of devices
- Bulk firmware upgrade and file backup

### Commissioning of new devices

Allows a network of ROS devices to be commissioned in place on the network with no prior configuration necessary. Capable of discovering and configuring ROS devices that have been taken directly from the factory and connected to the network.

### Bulk configuration or reconfiguration

Modifies the network and identification configuration parameters of one or multiple ROS devices, either one at a time, or using a template-based auto-incrementing tool.

### Asset reporting

Generate a report of ROS based network device assets on a network segment. If RCDP is supported on all devices, RUGGEDCOM EXPLORER need not have any prior knowledge of IP addressing used by ROS devices.

IP Address	Host	Default Gateway	MAC address	System Name	OS Version	Serial Number	Order Code	Location	Contact
10.8.1.23	205.0.0.0	10.8.0.1		ruggedcom-02-17-bd	v3.8.1 (May ...)	R300007-0304...	R300007-HD...		
10.200.205.212				ruggedcom-3e-a1-80	v3.8.0 (Mar ...)	R3000w-0410-C...	R3000wHC...		
10.200.22.184		10.200.16.1		ruggedcom-58-21-80	v3.8.3 (Nov ...)	500-0211-39934	R3000-H4...		
10.200.52.16				ruggedcom-58-a8-80	v3.8.3 (Nov ...)	5006-0211-18822	R3000HC-H...		
192.168.0.1	192.168.255.0			ruggedcom-51-19-80	v3.8.1 (May ...)	R21C-0911-13470	R621100-A...		
192.168.0.2	192.168.255.0			ruggedcom-3f-a7-20	v3.7.3 (Sep ...)	500-0310-37024	R3000-H4-D...		
192.168.0.3	192.168.255.0			ruggedcom-35-54-80	v3.10.0 (Oct ...)	5006-1109-08447	R3000G-H4-P...		
192.168.0.4	192.168.255.0			ruggedcom-3c-1e-a0	v3.8.3 (May ...)	R02-0911-00000	R02MC-4A-A...		
192.168.0.5	192.168.255.0			ruggedcom-4c-87-00	v3.8.1 (May ...)	R000-0911-02087	R3000-H4-H...		
192.168.0.6	192.168.255.0			ruggedcom-53-82-a0	v3.8.2 (Mar ...)	500-1210-30537	R3000-H4-C...		
192.168.1.222	192.168.255.0			ruggedcom-49-af-00	v3.8.1 (May ...)	R4-0810-02543	R30000-H4-C...		
199.199.199.199	192.168.255.0			ruggedcom-05-ad-5c	v3.7.4 (Nov ...)	R1900-0907-1159	R1900-09-T...		

RUGGEDCOM EXPLORER

### Network debugging

Reports the occurrence of duplicate IP addresses, or inconsistencies in IP address allocation among ROS devices. Note that RCDP support is required in order to detect certain IP addressing misconfigurations.

### Bulk firmware upgrade

Upgrades the firmware of one or multiple devices at once.

### System backup

Archives in one single step the configuration, firmware, log, and other ancillary files of one or multiple devices.

### Diagnostic data retrieval

Retrieved and archives diagnostic data (system logs and alarms) from one or multiple devices can be in a single step.

## System requirements

Component	Specification
Operating system	Microsoft Windows XP Service Pack 3 Windows 7 Windows 8 (32 and 64 bit)

# RUGGEDCOM PING

## High accuracy graphical ping utility

RUGGEDCOM PING is a high accuracy graphical ping tool useful for monitoring a list of devices in order to measure in detail the performance and behavior of the self-healing mechanisms of fault-tolerant networks.

Fault-tolerant networks are typically designed with some inactive, or standby, redundant connections. When an active connection is interrupted, the network works to converge on a solution that results in it regaining full connectivity. RUGGEDCOM PING is designed to measure the time it takes from the moment the network is damaged to the time it regains full connectivity.

RUGGEDCOM PING only requires the tested devices to support the ubiquitous 'Internet Control Message Protocol' (ICMP - Internet RFC-792) better known as 'ping' that is implemented by the vast majority of IP devices. RUGGEDCOM PING can send ICMP echo messages and process incoming responses with a granularity of 1ms.

### Features

- Flexible and configurable network auto-discovery mechanism
- Millisecond resolution of events both initiated and detected by the system
- Testing, monitoring and measurement of up to 256 IP devices concurrently
- Real-time display of test progress
- Generation of test reports in HTML format
- Option to save discovered nodes for later retrieval and use

### System requirements

Component	Specification
Operating system	Microsoft Windows XP SP2 Windows 7 Windows 8



## Security information

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