



The RuggedRouter™ RX1000 is an industrially hardened cyber security appliance with integrated router, firewall, and VPN functionality. The RX1000 can be used to establish an electronic security perimeter around critical cyber assets found in control and automation systems, in order to prevent the disruption of operations by accidental or malicious acts. Ideally suited for electric power utilities, the industrial plant floor, and traffic control systems, the RX1000 is designed to protect and secure SCADA system networks connected directly to the Internet, or within a company's Wide Area Network (WAN) or Local Area Network (LAN).

The RX1000 includes security functions such as full IPsec Virtual Private Networking (VPN), and firewall capabilities with the capacity to securely connect hundreds of other remote sites over Frame Relay and PPP. The modular architecture allows customization of the number and types of Ethernet and WAN ports. Integrated modem and GPS time synchronization options are also available.

The RX1000 is hardened to the RuggedRated™ specification which provides a high level of immunity to electromagnetic interference (EMI) and heavy electrical surges typical of the harsh environments found in many industrial applications. An operating temperature range of -40 to +85°C (-40 to +185°F) allows the RX1000 to be placed in almost any location.

For applications requiring high availability, the RX1000 provides the option for integrated dual redundant power supplies each capable of accommodating a wide range of input voltages for worldwide operability. Also unique is the ability to have each power supply fed from different voltage levels and/or sources thereby providing great flexibility in creating high availability systems.

Key Features and Benefits

Security Appliance Functions

- Integrated Router/Firewall/VPN
- Stateful Firewall with NAT
- Full IPsec Virtual Private Networking
- VPN with 3DES, AES128, AES256 support

RuggedRated™ for Reliability in Harsh Environments

- Immunity to EMI and high voltage electrical transients
 - Meets IEEE 1613 (electric utility substations)
 - Exceeds IEC 61850-3 (electric utility substations)
 - Exceeds IEEE 61800-3 (variable speed drive systems)
 - Exceeds IEC 61000-6-2 (generic industrial environment)
 - Exceeds NEMA TS-2 (traffic control equipment)
- -40°C to +85°C operating temperature (no fans)

- Failsafe Output Relay: For critical failure or error alarming
- 18 AWG galvanized steel enclosure and 19" rack-mount adapter

Physical Ports

- Ethernet Options (up to 4 ports):
 - 10/100BaseTX, 100BaseFX
- WAN Port Options (up to 8 ports):
 - T1/E1 (channelized/unchannelized)
 - supports 2Mbps G.703 with 120 ohm balanced connections
 - T3/E3 DS3
 - 56 Kbps DDS and DSL
- Serial Ports (up to 8 ports):
 - Fully compliant EIA/TIA RS485, RS422, RS232 serial ports (software selectable) – RJ45 connectors
 - Raw socket mode support allows conversion of any serial protocol
- Embedded Modem Port
- GPS IRIG-B Time Sync (coming soon)

Protocols

- WAN
 - Frame Relay RFC 1490 or RFC 1294
 - PPP RFC 1661, 1332, 1321, 1334, PAP, CHAP Authentication
 - PPPoE over DSL
- IP
 - Routing
 - VRRP, OSPF, DHCP Agent
 - Traffic prioritization, NTP Host (Stratum 2)

Frame Relay Support

- ISO and ITU compliant, network certified.
- ANSI T1.617 Annex D, Q.933 or LMI Local Signaling

Management Tools

- Web-based, SSH, CLI management interfaces
- SNMP v2/v3
- Remote Syslog
- Rich set of diagnostics with logging and alarms
- WAN tools for engineering level debugging
- Raw and interpreted real time line traces

Universal Power Supply Options

- Fully integrated power supplies (no external adaptors)
- Input voltage range of 9-59VDC, 88-300VDC, and 85-264VAC for worldwide operability
- Optional dual redundant, parallel load-sharing power supplies for increased network availability
- Can be powered from different sources for ultimate redundancy
- CSA/UL 60950 safety approved



RuggedRouter™ RX1000**Multiple Ethernet Ports:**

- ▶ Up to 4 100 Mbps ports
- ▶ Fiber or Copper
- ▶ LC, ST, MTRJ, SC

Multiple WAN Ports:

- ▶ Up to 8 T1/E1
- ▶ Dual DSL
- ▶ Dual DDS 56kbps
- ▶ T3/E3 DS3

Modular HMI

- ▶ Front or Rear Mount

**GPS / IRIG Ports (coming soon):**

- ▶ Built-in GPS, Antenna Input
- ▶ Multiple IRIG-B Outputs
- ▶ Manchester, AM, Baseband IRIG-B Types

V.90 Modem (Optional);

- ▶ 56kbps

Serial Ports

- ▶ 4 or 8 ports
- ▶ Software Selectable RS232/RS422/RS485
- ▶ RJ45 connector

Mounting Options

- ▶ Panel/Din rail
- ▶ 19" Rack Mount

Enclosure:

- ▶ IP40
- ▶ 18 AWG Galvanized Steel

Operating Temperature

- ▶ -40°C to +85°C
- ▶ No Fans

**Integrated Power Supply:**

- ▶ 24VDC (9-36VDC), 48VDC (36-59VDC), or HI (88-300VDC/85-264VAC) power supply options
- ▶ Optional Dual Redundant Power Supply with Parallel Load Sharing

EMI Immunity

- ▶ Meets IEEE 1613 (electric utility substations)
- ▶ Exceeds IEC 61850-3 (electric utility substations)
- ▶ Exceeds IEEE 61800-3 (variable speed drive systems)
- ▶ Exceeds IEC 61000-6-2 (generic industrial environment)
- ▶ Exceeds NEMA TS-2 (traffic control equipment)

Router Software Features



Frame Relay Central Site Concentration

RuggedRouter Frame Relay provides the ability to inexpensively network a large number of widely separated remote sites via a Frame Relay network provider. A number of remote sites are established, using physical interfaces such as 56Kbps DDS, Fractional or full T1, and in some cases broadband DSL. Remote sites may be fully meshed, but typically connect only to a central site. The central site typically employs one or more T1 connections and routes data between remote sites if required. Data link connections are configured to carry traffic from the remote sites to the central site. The maximum traffic rate and traffic bursting characteristics can be programmed individually for each connection. The connection can then be treated as a routed IP link. Traffic shaping policies (see below) can then be applied to the link.

PPP Networking

Certain remote sites may be located "off" of the Frame Relay network or may be infrequently used. RuggedRouter supports the ability to allocate a portion of the central site channelized T1 line for connection to these remote sites. The T1 link can then simultaneously support IP over Frame Relay connections to the Frame network and PPP connections to off-net devices. PPP can be employed on the embedded modem, over unchannelized T1 lines or as PPPoE using the broadband DSL card.

Virtual Private Networking

Virtual private networking provides the ability to treat your remote sites as if they are part of a secure private network, by creating secure tunnels through untrusted networks. All traffic on those tunnels is encrypted. The RuggedRouter allows you to establish a tunnel to each of your remote sites with strong authentication and encryption. Tunnels may be constructed to the site as a whole, to specific hosts on specific ports at the remote site or passed through to the hosts.

Firewalls

Firewalls restrict traffic between specific hosts using specific services. RuggedCom provides easy to configure, robust firewalls that operate in conjunction with VPN. Network Address Translation (NAT), Port Forwarding and message logging are only some of the features provided by the firewall.

Traffic Prioritization

Traffic shaping is the ability to prioritize the transmission of data over a network link. Traffic prioritization is used to optimize or guarantee performance, low-latency, and/or bandwidth. The RuggedRouter can prioritize based on wide number of criteria, including: type of protocol, TOS fields in received packets, IP address and port numbers.

VRRP (Virtual Router Redundancy Protocol)

VRRP is an Internet protocol that provides a way to have one or more backup routers when using a statically configured router on a local area network (LAN). Using VRRP, a virtual IP address can be specified as a default. A virtual IP address is shared among the routers, with one designated as the master router and the others as backups. In case the master fails, the virtual IP address is mapped to a backup router's IP address. (This backup becomes the master router.) The MAC address of the Virtual IP address is also not changed, but is moved from the malfunctioning master router to the backup master, making sure that Mac Address tables are kept current and unchanged.

OSPF (Open Shortest Path First)

OSPF is a routing protocol that determines the best path for routing IP traffic over a TCP/IP network based on link states between nodes and several quality parameters. OSPF is an interior gateway protocol (IGP), which is designed to work within an autonomous system. It is also a link state protocol, meaning that the best route is determined by the type and speed of the inter-router links, not by how many router hops they are away from each other (as in Distance-Vector routing protocols, i.e. Rip and RIP II).

PPP Networking Extended (Point-to-Point Protocol)

The most popular method for transporting IP packets over a serial link between the user and the ISP. Developed in 1994 by the IETF and superseding the SLIP protocol, PPP establishes the session between the user's computer and the ISP using its own Link Control Protocol (LCP). PPP supports PAP and CHAP authentication, as well as EAP, which is a conduit for numerous other authentication methods. PPP can run on any full-duplex link from POTS to ISDN to T1, etc. On dial-up connections, PPP can hang up a low-quality call and redial.

Router Software Features



Using Multilink PPP (MPPP), two modems and phone lines can be bonded together to increase speed. PPP encapsulates high-level protocol packets in HDLC-based frames; for example, IP over PPP (IPCP) for the Internet and IPX over PPP (IPXCP) for NetWare networks, and it can multiplex different protocols over the same circuit. PPP also supports Ethernet frames for DSL and cable modem hookups (PPPoE).

Automatic Dial Backup (coming soon)

Automatic Dial Backup provides capability to raise a backup connection to a RAS server upon failure of the designated link. The RuggedRouter can operate the dynamic link as a stand-alone entity or bond it with a pre-existing Multilink PPP bundle.

NTP and GPS (coming soon)

The Network Time Protocol allows Intelligent Electronic Devices (IED) and Remote Terminal Units (RTU) to obtain accurate time information from NTP hosts. The RuggedRouter features a GPS system that obtains timing information from GPS satellites and will act as an NTP host, providing stratum 2 quality resolution. Multiple types of IRIG-B outputs are available including AM, Baseband, and Manchester.

Serial IP Encapsulation

Many 'legacy' devices (RTU, PLC, IED, etc.) only support serial communications via RS232, RS422 or RS485. ROX™ encapsulates the serial data within a TCP connection allowing these devices to be reached via an IP network. A wide range of baud rates, frame packetization options, and diagnostics are available and the raw socket support allows conversion of any serial protocol.

HTML Web-Browser and Telnet

ROX™ provides a simple, intuitive user interface for configuration and monitoring via a standard graphical web browser or via Telnet. All system parameters include detailed on-line help to make setup a breeze. ROX™, presents a common look and feel and standardized configuration process allowing easy migration to other RuggedCom managed products.

SNMP (Simple Network Management Protocol)

SNMP provides a standardized method for network management stations the ability to interrogate devices from different vendors. SNMP versions supported by ROX™ are v1, v2c, and v3. SNMPv3 in particular provides security features (such as authentication, privacy, and access control) not present in earlier SNMP versions. ROX™ also supports numerous standard MIBs (Management Information Base) allowing for easy integration with any network management system (NMS). A feature of SNMP supported by ROX™ is the ability to generate "traps" upon system events. A NMS can record traps from multiple devices providing a powerful network troubleshooting tool. RuggedVue is RuggedCom's NMS that provides graphical visualization of the network and is fully integrated with all RuggedCom products.

Port Configuration and Status

ROX™ allows individual ports to be 'hard' configured for speed, duplex, auto-negotiation, flow control and more. This allows proper connection with devices that do not negotiate or have unusual settings. Detailed status of ports with alarm and SNMP trap on link problems aid greatly in system troubleshooting.

Port Statistics and RMON (Remote Monitoring)

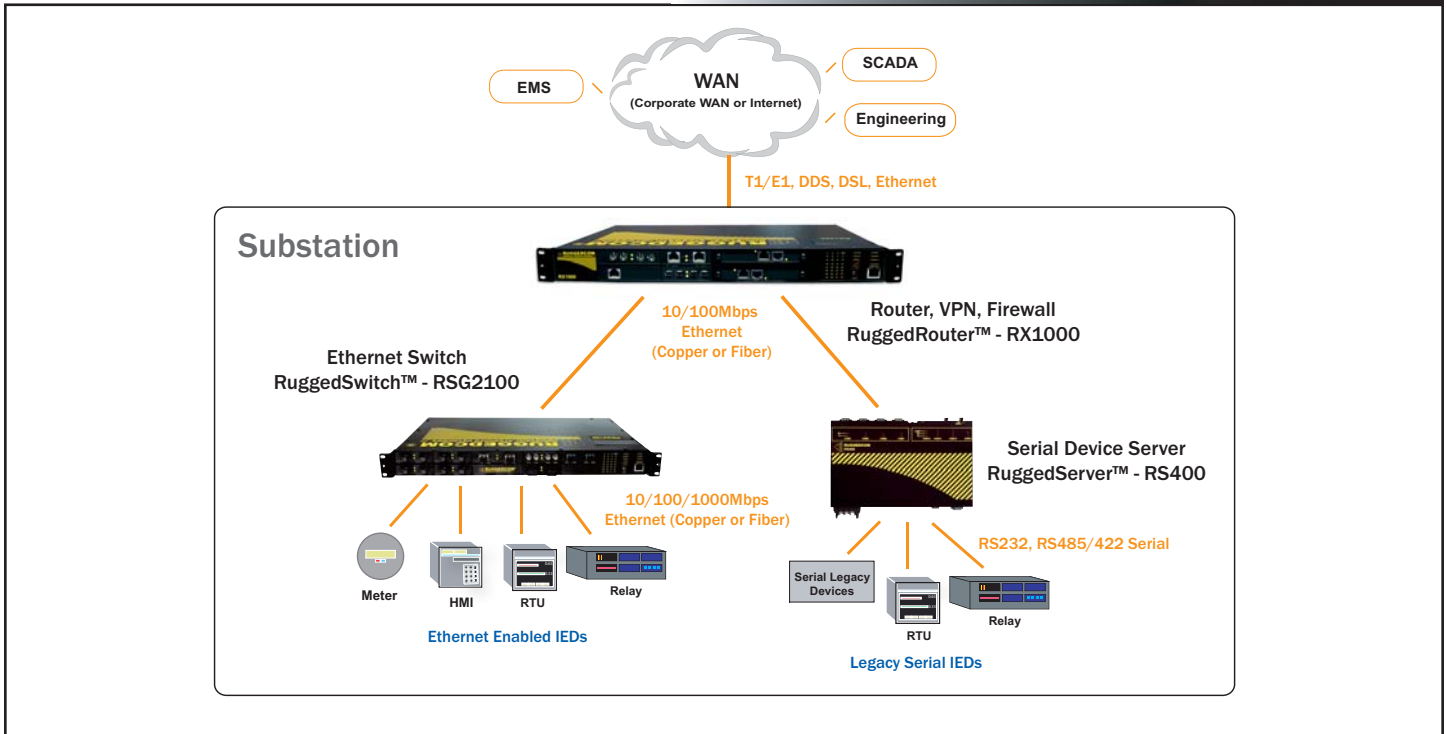
ROX™ provides continuously updating statistics per port that provide both ingress and egress packet and byte counters as well as detailed error figures. Also provided is full support for the RMON statistics, history, alarms, and event groups. RMON allows for very sophisticated data collection, analysis and detection of traffic patterns.

Event Logging and Alarms

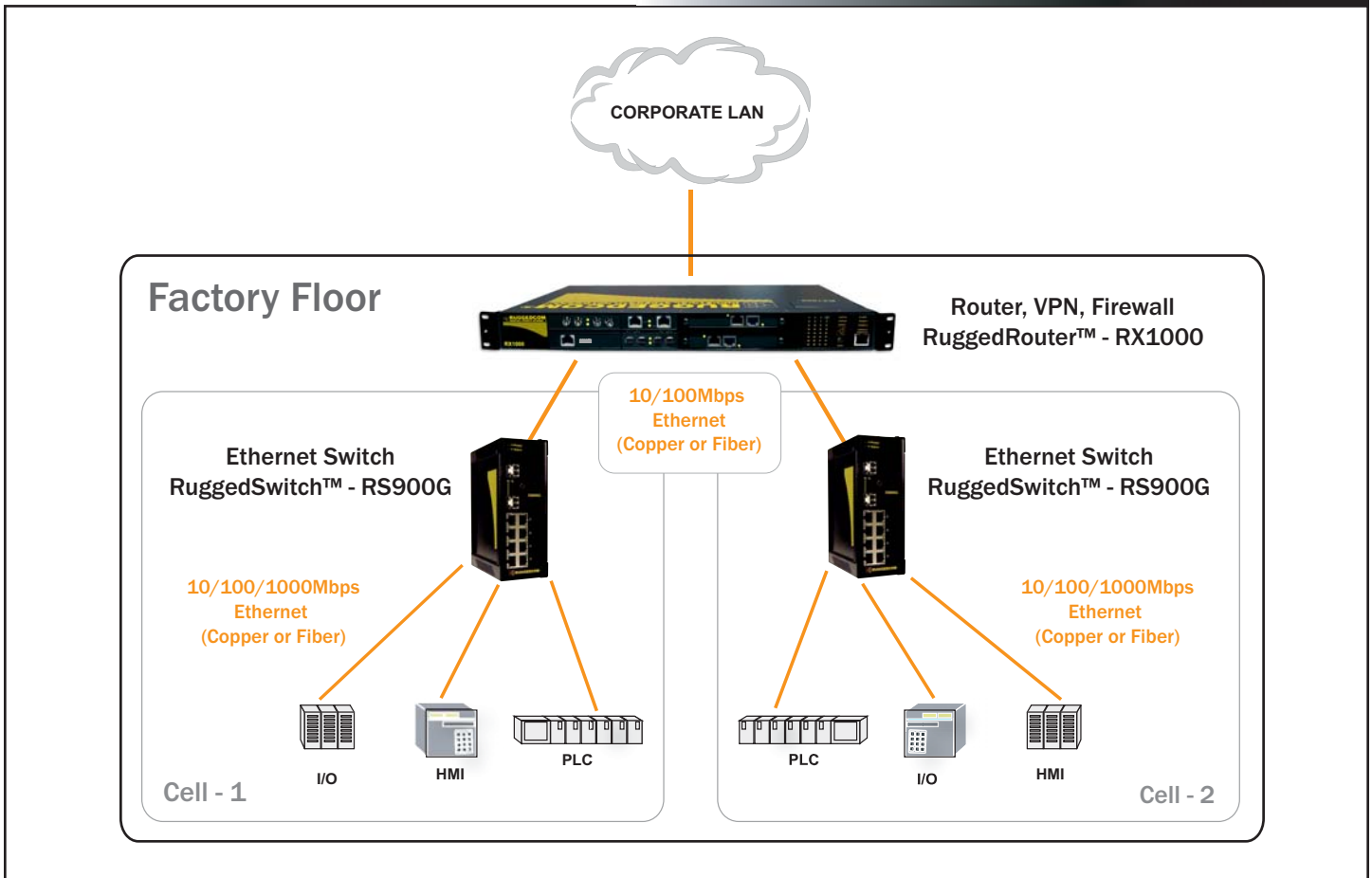
ROX™ records all significant events to a non-volatile system log allowing forensic troubleshooting. Events include link failure and recovery, unauthorized access, broadcast storm detection, and self-test diagnostics among others. Alarms provide a snapshot of recent events that have yet to be acknowledged 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.

Application Examples

Electric Utility Substation



Industrial Plant Floor



EMI and Environmental Type Tests

IEC 61850-3 EMI TYPE TESTS				
TEST	Description		Test Levels	Severity Levels
IEC 61000-4-2	ESD	Enclosure Contact	+/- 8kV	4
		Enclosure Air	+/- 15kV	4
IEC 61000-4-3	Radiated RFI	Enclosure ports	20 V/m	x
IEC 61000-4-4	Burst (Fast Transient)	Signal ports	+/- 4kV @ 2.5kHz	x
		D.C. Power ports	+/- 4kV	4
		A.C. Power ports	+/- 4kV	4
		Earth ground ports ³	+/- 4kV	4
IEC 61000-4-5	Surge	Signal ports	+/- 4kV line-to-earth, +/- 2kV line-to-line	4
		D.C. Power ports	+/- 2kV line-to-earth, +/- 1kV line-to-line	3
		A.C. Power ports	+/- 4kV line-to-earth, +/- 2kV line-to-line	4
IEC 61000-4-6	Induced (Conducted) RFI	Signal ports	10V	3
		D.C Power ports	10V	3
		A.C. Power ports	10V	3
		Earth ground ports ³	10V	3
IEC 61000-4-8	Magnetic Field	Enclosure ports	40 A/m continuous, 1000 A/m for 1 s	N/A
IEC 61000-4-29	Voltage Dips & Interrupts	D.C. Power ports	30% for 0.1s, 60% for 0.1s, 100% for 0.05s	N/A
IEC 61000-4-11		A.C. Power ports	30% for 1 period, 60% for 50 periods 100% for 5 periods, 100% for 50 periods ²	N/A
IEC 61000-4-12	Damped Oscillatory	Signal ports	2.5kV common, 1kV diff. mode@1MHz	3
		D.C. Power ports	2.5kV common, 1kV diff. mode@1MHz	3
		A.C. Power ports	2.5kV common, 1kV diff. mode@1MHz	3
IEC 61000-4-16	Mains Frequency Voltage	Signal ports	30V Continuous, 300V for 1s	4
		D.C. Power ports	30V Continuous, 300V for 1s	4
IEC 61000-4-17	Ripple on D.C. Power Supply	D.C. Power ports	10%	3
IEC 60255-5	Dielectric Strength	Signal ports	2kVac (Fail-Safe Relay output)	N/A
		D.C. Power ports	2kVac	N/A
		A.C. Power ports	2kVac	N/A
IEC 60255-5	H.V. Impulse	Signal ports	5kV (Fail-Safe Relay output)	N/A
		D.C. Power ports	5kV	N/A
		A.C. Power ports	5kV	N/A

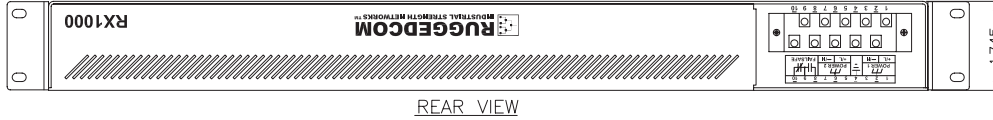
IEEE 1613 (C37.90.x) EMI IMMUNITY TYPE TESTS				
Test	Description		Test Levels	Severity Levels
IEEE C37.90.3	ESD	Enclosure Contact	+/- 8kV	N/A
		Enclosure Air	+/- 15kV	N/A
IEEE C37.90.2	Radiated RFI	Enclosure ports	35 V/m	N/A
IEEE C37.90.1	Fast Transient	Signal ports	+/- 4kV @ 2.5kHz	N/A
		D.C. Power ports	+/- 4kV	N/A
		A.C. Power ports	+/- 4kV	N/A
		Earth ground ports ³	+/- 4kV	N/A
IEEE C37.90.1	Oscillatory	Signal ports	2.5kV common mode @1MHz	N/A
		D.C. Power ports	2.5kV common, 1kV diff. mode@1MHz	N/A
		A.C. Power ports	2.5kV common, 1kV diff. mode@1MHz	N/A
IEEE C37.90	H.V. Impulse	Signal ports	5kV (Fail-Safe Relay output)	N/A
		D.C. Power ports	5kV	N/A
		A.C. Power ports	5kV	N/A
IEEE C37.90	Dielectric Strength	Signal ports	2kVac	N/A
		D.C. Power ports	2kVac	N/A
		A.C. Power ports	2kVac	N/A

Environmental Type Tests				
Test	Description		Test Levels	Severity Levels
IEC 60068-2-1	Cold Temperature	Test Ad	-40°C, 16 Hours	N/A
IEC 60068-2-2	Dry Heat	Test Bd	+85°C, 16 Hours	N/A
IEC 60068-2-30	Humidity (Damp Heat, Cyclic)	Test Db	95% (non-condensing), 55°C, 6 cycles	N/A
IEC 60255-21-1	Vibration	Tests Fc	2g @ (10 - 150) Hz	Class 2
IEC 60255-21-2	Shock	Tests Ea	30g @ 11mS	Class 2

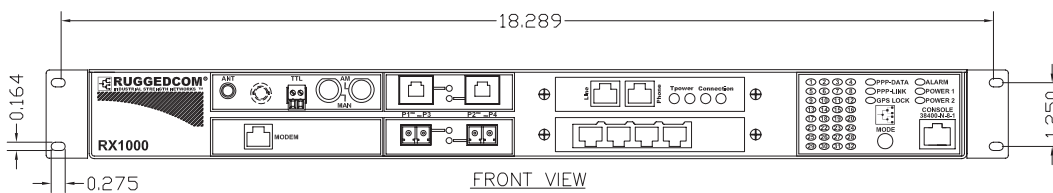
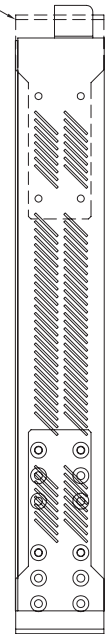
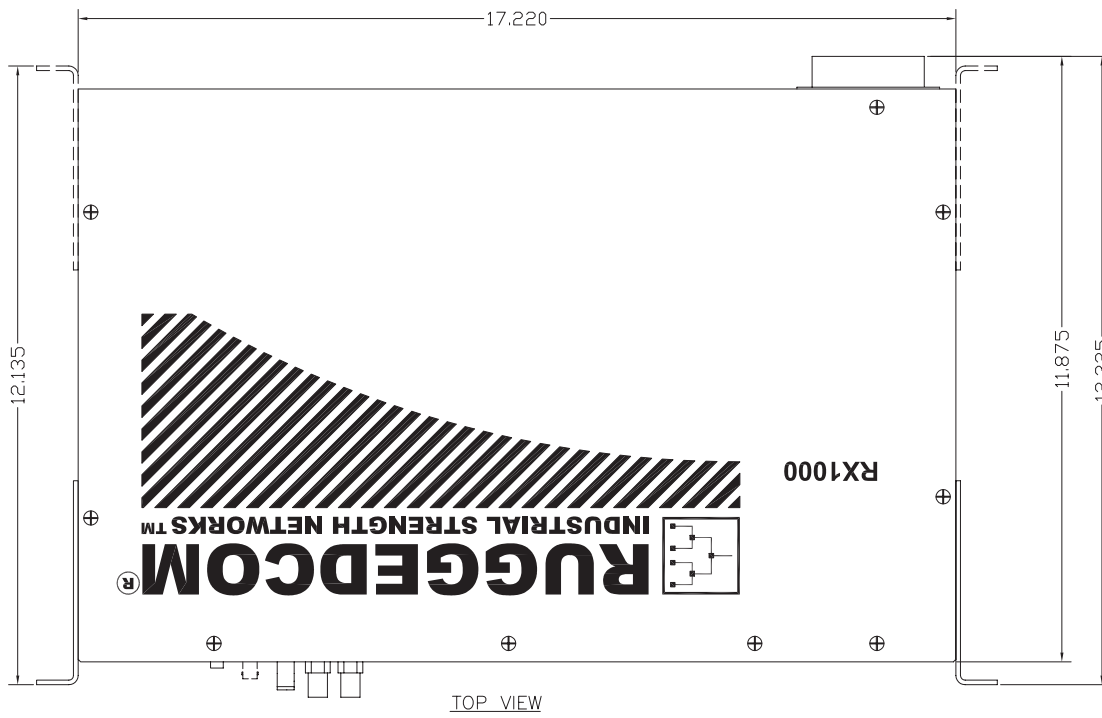
Notes:

1. Only applicable to functional earth connections separated from the safety earth connection.
2. Class 2 refers to "Measuring relays and protection equipment for which a very high security margin is required or where the vibration levels are very high, (e.g. shipboard application and for severe transportation conditions")

Mechanical Drawing

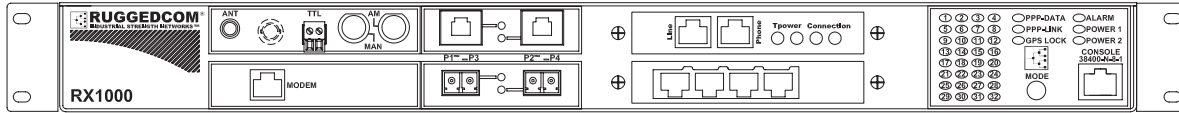


RACK MOUNT BRACKETS
FRONT OR REAR. BRACKETS CAN
ALSO BE MOVED BACK UP TO ONE INCH.



Mounting Options

19" Rack Front Mount - (Connectors At Front)



FRONT VIEW

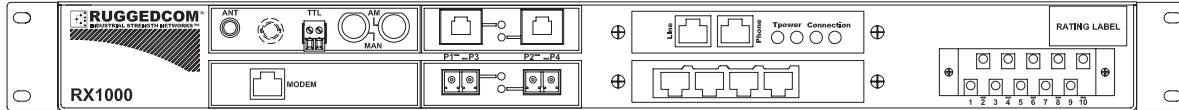


REAR VIEW

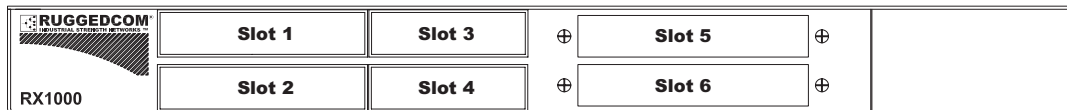
19" Rack Rear Mount - (Connectors At Rear)



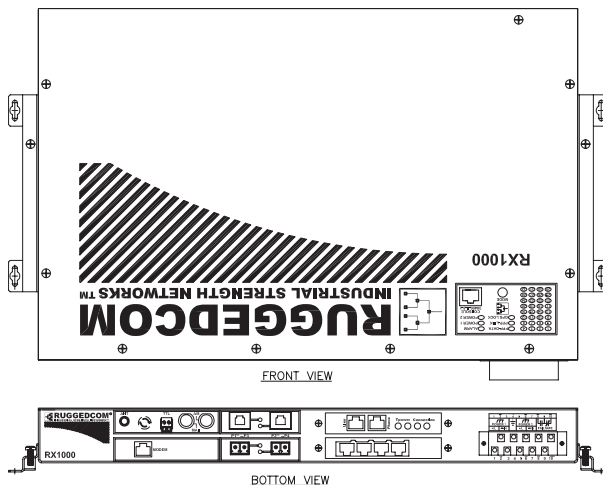
FRONT VIEW



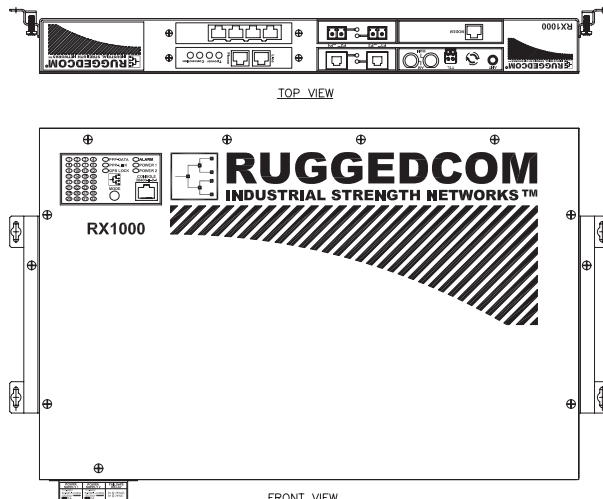
REAR VIEW



Panel / DIN Rail Bottom Mount - (Connectors At Bottom)



Panel / DIN Rail Top Mount - (Connectors At Top)



Technical Specifications

Power Supply

- Power Consumption: 25W (MAX)
- 24VDC: 9-36VDC (MAX)
- 48VDC: 36-59VDC (MAX)
- HI VOLTAGE AC/DC: 88-300VDC, 85-264VAC (MAX)

Critical Alarm Relay

- Form-C failsafe contact relay: 1A@30VDC

Physical

- Height: 1.74"
- Width: 17.2"
- Depth: 11.9"
- Weight: 10lbs (4.5 Kg)
- Ingress Protection: IP40 (1mm objects)
- Enclosure: 18 AWG galvanized steel enclosure
- Mounting: Panel/DIN Rail mount or 19 inch Rack Mount

Approvals

- ISO: Manufactured in an ISO9001 facility
- cCSAus: CSA C22.2 No. 60950, UL 60950 (pending)
- CE Marking (pending)
- Emissions: FCC Part 15, Class A (pending)
- Complies with 21 CFR Chapter 1, Subchapter J. (pending)
- NEMA TS-2 (pending)

Warranty

- 5 Years-Applicable to design or manufacturing related product defects.

Network Management

- HTTP graphical web-based
- SNMP v2/v3
- Command Line Interface (Console and Remotely via SSH)
- Quick setup facility

EMI Immunity and Environmental Compliance

- IEC 61000-6-2 Industrial (Generic)
- IEC 61800-3 Industrial (Variable Speed Drive Systems)
- IEC 61850-3 Electric Utility Substations
- IEEE 1613 Electric Utility Substations
- NEMA TS-2 Traffic Control Equipment (pending)

IEEE Compliance

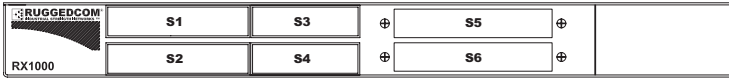
- 802.3-10BaseT
- 802.3u-100BaseTX, 100BaseFX

IETF RFC Compliance

- RFC791-IP
- RFC792-ICMP
- RFC793-TCP
- RFC783-TFTP
- RFC826-ARP
- RFC768-UDP
- RFC854-Telnet
- RFC1490-Frame Relay
- RFC1294-Frame Relay
- RFC1661-PPP
- RFC1332-PPP (IPCP)
- RFC1321-PPP (MD5)
- RFC1334-PPP Authentication
- RFC1519-CIDR
- RFC1541-DHCP (client)
- RFC1305-NTP
- RFC2068-HTTP
- RFC2338-VRRP
- RFC2475-Differentiated Services

Order Codes

RX1000 - _____ - _____ - _____ - _____ - _____ - _____ - _____ - _____ - _____
 Main Mount PS1 PS2 S1 S2 S3 S4 S5 S6



Main: Ethernet and Power Connectors

- R = Ethernet on rear; LED panel on front; power connector on rear
- F = Ethernet on front; LED panel on front; power connector on rear
- B = Ethernet on rear; LED panel on top; power connector on rear
- T = Ethernet on front; LED panel on top; power connector on rear

Mount: Mounting Options

- RM = 19" Rack Mount Kit
- DP = DIN and Panel Mount Kit
- RD = 19" Rack, DIN, and Panel Mount Kit
- 00 = No Mounting Option

PS1 and PS2: Power Supply 1 and Redundant

Power Supply

- 24 = 24VDC (9-36VDC), screw terminal block
- 48 = 48VDC (36-59VDC), screw terminal block
- HI = 88-300VDC or 85-264VAC, screw terminal block
- 24P = 24VDC (9-36VDC), pluggable terminal block
- 48P = 48VDC (36-59VDC), pluggable terminal block
- HIP = 88-300VDC or 85-264VAC, pluggable terminal block
- 00 = No Power Supply (PS2 Only)

S1: Modules for Slot 1

- XX = Empty

S2: Modules for Slot 2

- XX = Empty
- M1 = V90 Modem

S3 and S4: Ethernet Modules for Slots 3 and 4

- XXXX = Empty
- TX01 = 2 x 10/100Tx RJ45
- FX01 = 2 x 100FX - Multimode, 1300nm, ST connectors
- FX02 = 2 x 100FX - Multimode, 1300nm, SC connectors
- FX11 = 2 x 100FX - Multimode, 1300nm, LC connectors
- FX03 = 2 x 100FX - Multimode, 1300nm, MTRJ connectors
- FX04 = 2 x 100FX - Singlemode, 1300nm, ST connectors, 20km
- FX05 = 2 x 100FX - Singlemode, 1300nm, SC connectors, 20km
- FX06 = 2 x 100FX - Singlemode, 1300nm, LC connectors, 20km
- FX07 = 2 x 100FX - Singlemode, 1300nm, SC connectors, 50km
- FX08 = 2 x 100FX - Singlemode, 1300nm, LC connectors, 50km
- FX09 = 2 x 100FX - Singlemode, 1300nm, SC connectors, 90km
- FX10 = 2 x 100FX - Singlemode, 1300nm, LC connectors, 90km

S5 and S6: RX1000 Modules for Slots 5 and 6

- XXX = Empty
- TC1 = Single T1/E1 Channelized/Unchannelized
- TC2 = Dual T1/E1 Channelized/Unchannelized
- TC4 = Quad T1/E1 Channelized/Unchannelized
- DS3 = Clear Channel T3/E3 DS3 card
- D01 = DSL
- D02 = 56 kbps DDS DSU/CSU ⁽¹⁾
- TS1 = GPS IRIG-B Time Sync (coming soon) ⁽²⁾
- S01 = 4 x RS232/RS422/RS485 via RJ45

NOTES:

- ¹ This module has an operating temperature range of -40°C to +50°C.
² Only one (1) GPS card can be configured per router.

Example Order Codes

RX1000-R-RM-24-00-XX-XX-TX01-TX01-TU2-XXX

19" Rack mounted, single 24VDC power supply, 4 10/100 RJ45 Ethernet ports, Dual T1 WAN interface, with Ethernet ports on the rear

RX1000-F-RM-48-48-XX-XX-FL01-FX02-TU4-XXX

19" Rack mounted, dual redundant 48VDC power supply, 2 FL01 Multimode 850nm Fiber and 2 FX02 Singlemode 1300nm Fiber Ethernet ports, Quad T1 WAN interface, with Ethernet ports on the front

RX1000-R-RM-24-HI-XX-XX-TX01-FX05-TC2-XXX

19" Rack mounted, dual redundant power supply (mixed voltage), 2 10/100 RJ45 and 2 1300nm Singlemode Fiber Ethernet ports, Quad T1 Channelized WAN interface, with Ethernet ports on the rear

Accessories

- 42-11-0021 - Cable support brackets (two)
- 43-10-0007 - Power cable (North America three prong connector -> beau)

RuggedCom Inc.

30 Whitmore Road

Woodbridge, Ontario, Canada L4L 7Z4

Tel: (905) 856-5288 Fax: (905) 856-1995

Toll Free: (888) 264-0006

Technical Support Center: (866) 922-7975 or (954) 922-7975

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Patent Pending

All specifications in this document are subject to change without notice.

Rev 2-L

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