SIEMENS

RUGGEDCOM RX1100

Installation Guide

6/2014
RC1051-EN-02

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Table of Contents

Preface

This guide describes the RUGGEDCOM RX1100. It describes the major features of the device, installation, commissioning and important technical specifications.

It is intended for use by network technical support personnel who are responsible for the installation, commissioning and maintenance of the device. It is also recommended for use by network and system planners, system programmers, and line technicians.

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.

Related Documents

Other documents that may be of interest include:

- *ROX User Guide for the RX1100*

Accessing Documentation

The latest Hardware Installation Guides and Software User Guides for most RUGGEDCOM products are available online at www.siemens.com/ruggedcom.

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  - Submit SRs or check on the status of an existing SR
  - Find and contact a local contact person
  - Ask questions or share knowledge with fellow Siemens customers and the support community via the forum
  - And much more...

1 Introduction

The RX1100 is an industrially hardened cyber security appliance with integrated router, firewall and VPN functionality. The device may be equipped with up to four 10/100Base-TX 802.3af (PoE) copmliant Ethernet ports.

The RX1100 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 RX1100 is designed to protect and secure SCADA system networks connected to the Internet, or within a company's Wide Area Network (WAN) or Local Area Network (LAN). The device also adds Intrusion Detection and RUGGEDCOM Gauntlet® for NERC CIP compliance.

The RX1100 includes security functions such as full IPSec Virtual Private Networking (VPN), firewall capabilities with the capacity to securely connect hundreds of remote sites across a Wide Area Network, and Intrusion Detection Services for performing real-time network traffic analysis and packet logging on IP networks.

The modular architecture allows the customization of the number and type of Ethernet and WAN ports. Integrated modem and GPS time synchronization options are also available.

The RX1100 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 RX1100 to be placed in almost any location.

The following sections provide more information about the RX1100:

Section 1.1

Feature Highlights

Security Appliance Functions

- Integrated Router/Firewall/VPN
- Stateful Firewall with NAT
- Full IPSec Virtual Private Networking
- VPN with 3DES, DES and AES support
- Intrusion Detection Service (IDS)
- RADIUS centralized password management

Rated 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 to 85 °C (-40 to 185 °F) operating temperature (no fans)
- Failsafe output relay: for crtical failure or error alarming
- 18 AWG galvanized steel enclosure and 48 cm (19 in) rack-mount adapter

Universal Power Supply Options

- Fully integrated power supplies
- Input voltage range of 10-59 VDC, 88-300 VDC or 85-264 VAC 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 60950-1 safety approved to 85 °C (185 °F)

Physical Ports

- Ethernet Options (up to 4 ports): 10/100Base-TX, 100Base-FX
- Cellular Modem
- WAN Port Options (up to 8 ports):
  - T1/E1 (channelized/unchannelized) supports 2 Mbps G.703 with 120 Ω balanced connections
  - PPPoE/Bridged Ethernet via ADSL
  - T3 DS3
  - 56 Kbps DDS
- Serial Ports (up to 8 ports):
  - Fully compliant EIA/TIA RS485, RS422, RS232 software selectable serial ports with RJ45 connectors
  - Raw socket mode support allows conversion of any serial protocol
- Embedded Modem Port
- Precision Time Protocol (PTP): Accurate time synchronization using NTP, IRIG-B and/or IEEE1588

Protocols

- WAN
  - Frame Relay RFC 1490 or RFC 1294
  - PPP RFC 1661, 1332, 1321, 1334, PAP, CHAP Authentication
  - PPPoE over DSL
  - GOOSE messaging support
- IP
  - Routing: VRRP, OSPF, RIP, BGP
  - DHCP Agent (Option 82 capable)
  - Traffic prioritization, NTP Server, IP Multicast Routing

Frame Relay Support

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

Section 1.2

Ports, Controls and Indicator LEDs

The RX1100 features various ports, controls and indicator LEDs on the front panel for configuring and troubleshooting the device.

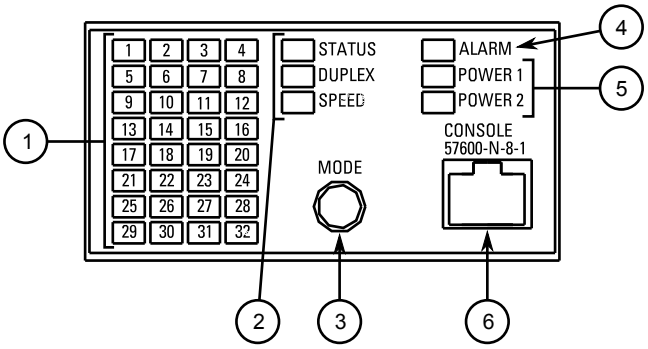

Figure 1: Front Panel

1. Port Status Indicator LEDs **2.** Display Mode Indicator LEDs **3.** Mode Button **4.** Alarm Indicator LED **5.** Power Module Indicator LEDs **6.** RS232 Serial Console Port (RJ45)

Port Status Indicator LEDs	These LEDs indicate the state of each port. When Status mode is selected, these LEDs indicate when ports are active. • Green (Solid) = Link detected • Green (Blinking) = Link activity • Off = No link detected When Duplex mode is selected, these LEDs indicate when ports are operating in full or half duplex mode. • Green (Solid) = Full duplex mode • Orange (Solid) = Half duplex mode • Off = No link detected When Speed mode is selected, these LEDs indicate the port speed. • Green (Solid) = 1000 Mb/s • Green (Blinking) = 100 Mb/s • Orange (Solid) = 10 Mb/s • Off = No link detected
Display Mode Indicator LEDs	These LEDs indicate the current display mode for the port status indicator LEDs (i.e. Status, Duplex or Speed).
Mode button	The **Mode** button sets the display mode for the port status indicator LEDs (i.e. Status, Duplex or Speed). It can also be used to reset the device if held for 5 seconds.
Alarm Indicator LED	The alarm indicator LED illuminates when an alarm condition exists.
Power Module Indicator LEDs	These LEDs indicate the status of the power modules. • Green = The power supply is supplying power • Red = Power supply failure • Off = No power supply is installed
RS232 Serial Console Port	This port is for interfacing directly with the device and accessing initial management functions.

2 Installing the Device

The following sections describe how to install the device, including mounting the device, installing/removing modules, connecting power, and connecting the device to the network.

WARNING!
Radiation hazard – risk of serious personal injury. This product contains a laser system and is classified as a CLASS 1 LASER PRODUCT. Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

DANGER!
Electrocution hazard – risk of serious personal injury and/or damage to equipment. Before performing any maintenance tasks, make sure all power to the device has been disconnected and wait approximately two minutes for any remaining energy to dissipate.

IMPORTANT!
This product contains no user-serviceable parts. Attempted service by unauthorized personnel shall render all warranties null and void.

Changes or modifications not expressly approved by Siemens Canada Ltd. could invalidate specifications, test results, and agency approvals, and void the user's authority to operate the equipment.

IMPORTANT!
This product should be installed in a restricted access location where access can only be gained by authorized personnel who have been informed of the restrictions and any precautions that must be taken. Access must only be possible through the use of a tool, lock and key, or other means of security, and controlled by the authority responsible for the location.

Section 2.1

Mounting the Device

The RX1100 is designed for maximum mounting and display flexibility. It can be equipped with connectors that allow it to be installed in a 48 cm (19 in) rack, 35 mm (1.4 in) DIN rail, or directly on a panel.

NOTE
For detailed dimensions of the device with either rack, DIN rail or panel hardware installed, refer to Chapter 5, Dimension Drawings.

The following sections describe the various methods of mounting the device:

- Section 2.1.1, “Mounting the Device to a Rack”
- Section 2.1.2, “Mounting the Device on a DIN Rail”
- Section 2.1.3, “Mounting the Device to a Panel”

Section 2.1.1
Mounting the Device to a Rack

For rack mount installations, the RX1100 can be equipped with rack mount adapters pre-installed at the front or rear of the chassis. Additional adapters are provided to further secure the device in high-vibration or seismically active locations.

To secure the device to a standard 48 cm (19 in) rack, do the following:

1. Make sure the rack mount adapters are installed on the correct side of the chassis.
   - To make the modules and ports accessible, install the rack mount adapters at the rear of the chassis
   - To make the management ports and LEDs accessible, install the rack mount adapters at the front of the chassis

   NOTE
   The chassis features multiple mounting holes, allowing the rack mount adapters to be installed up to 25 mm (1 in) from the face of the device.

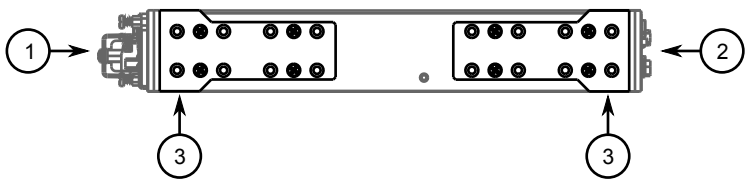

Figure 2: Rack Mount Adaptors

1. Rear **2.** Front **3.** Rack Mount Adaptor

2. If required, install adapters on the opposite side of the device to protect from vibrations.
3. Insert the device into the rack.

   NOTE
   Since heat within the device is channelled to the enclosure, it is recommended that 1 rack-unit of space, or 44 mm (1.75 in), be kept empty above the device. This allows a small amount of convectional airflow.

   Forced airflow is not required. However, any increase in airflow will result in a reduction of ambient temperature and improve the long-term reliability of all equipment mounted in the rack space.

4. Secure the adapters to the rack using the supplied hardware.

Section 2.1.2
Mounting the Device on a DIN Rail

For DIN rail installations, the RX1100 can be equipped with panel/DIN rail adapters pre-installed on each side of the chassis. The adapters allow the device to be slid onto a standard 35 mm (1.4 in) DIN rail.

To mount the device to a DIN rail, do the following:

1. Align the adapters with the DIN rails and slide the device into place.

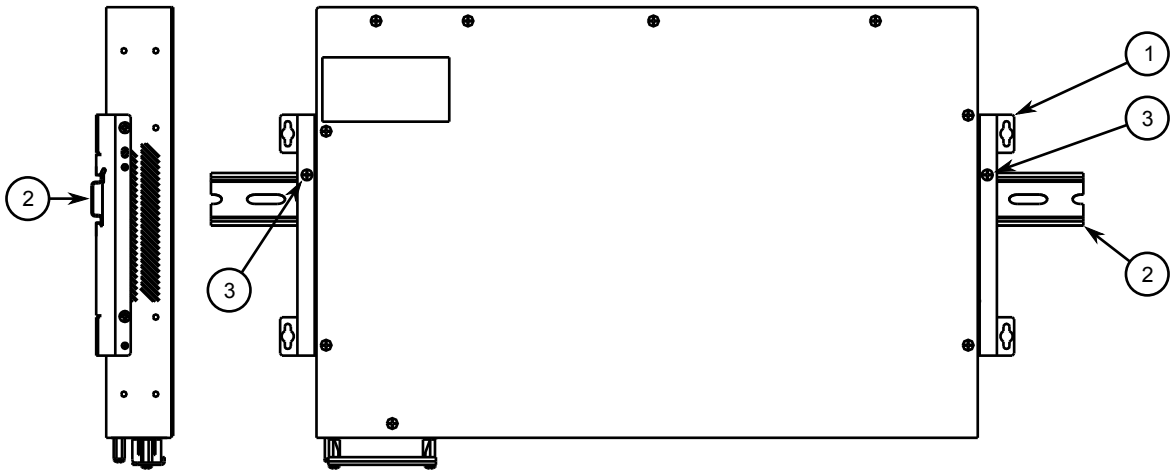

Figure 3: DIN Rail Mounting

1. Panel/DIN Rail Adaptor **2.** DIN Rail **3.** Screw

2. Install one of the supplied screws on either side of the device to secure the adapters to the DIN rails.

Section 2.1.3
Mounting the Device to a Panel

For panel installations, the RX1100 can be equipped with panel/DIN rail adapters pre-installed on each side of the chassis. The adapters allow the device to be attached to a panel using screws.

To mount the device to a panel, do the following:

1. Place the device against the panel and align the adapters with the mounting holes.

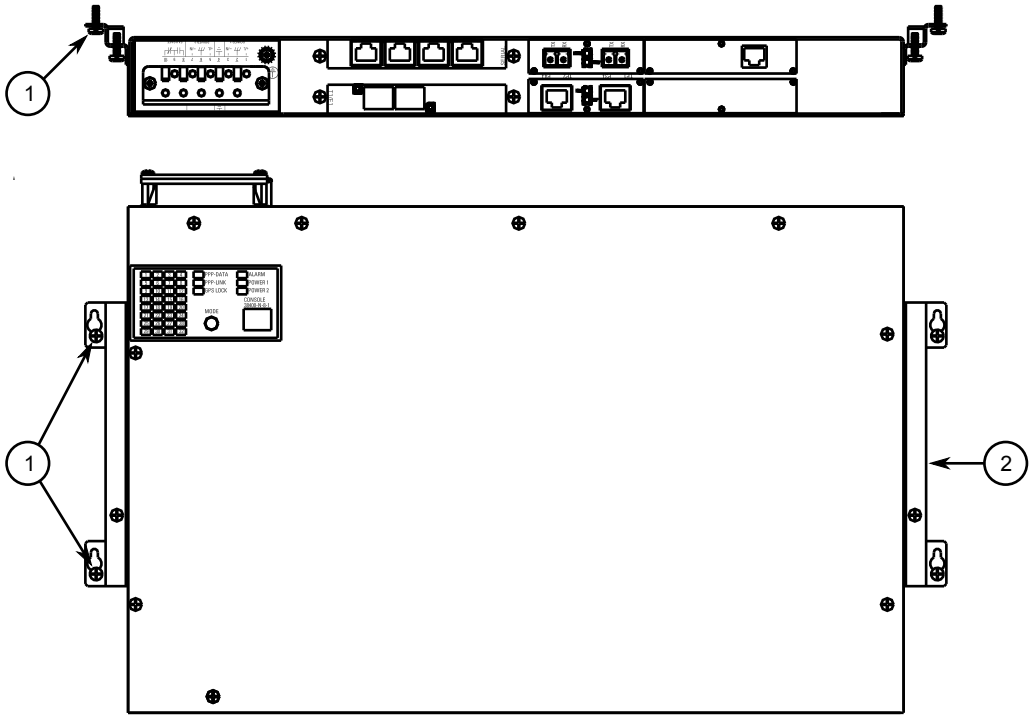

Figure 4: Panel Mounting

1. Screw **2.** Panel/DIN Rail Adaptor

2. Install the supplied screws to secure the adapters to the panel.

Section 2.2

Connecting Power

The RX1100 can be equipped with either a screw-type or pluggable terminal block, which provides power to both power supplies. The screw-type terminal block is installed using Phillips screws and compression plates, allowing either bare wire connections or crimped terminal lugs. Use #6 size ring lugs for secure, reliable connections under severe shock or vibration.

NOTE

- *For maximum redundancy in a dual power supply configuration, use two independent power sources.*
- *For 100-240 VAC rated equipment, an appropriately rated AC circuit breaker must be installed.*
- *For 88-300 VDC rated equipment, an appropriately rated DC circuit breaker must be installed.*
- *Use only #16 gage copper wiring when connecting terminal blocks.*
- *A circuit breaker is not required for 12, 24 or 48 VDC rated power supplies.*
- *It is recommended to provide a separate circuit breaker for each power supply module.*
- *Equipment must be installed according to applicable local wiring codes and standards.*

The following sections describe how to connect power to the device:

- Section 2.2.1, “Connecting AC Power”
- Section 2.2.2, “Connecting DC Power”
- Section 2.2.3, “Wiring Examples”

Section 2.2.1

Connecting AC Power

To connect a high AC power supply to the device, do the following:

CAUTION!
Electrical hazard – risk of damage to equipment. Do not connect AC power cables to terminals for DC power. Damage to the power supply may occur.

CAUTION!
Electrical hazard – risk of damage to equipment. Before testing the dielectric strength (HIPOT) in the field, remove the metal jumper. This metal jumper connects transient suppression circuitry to chassis ground and must be removed in order to avoid damage to transient suppression circuitry during testing.

NOTE
The terminal block is divided into separate terminals for each internal power supply. Make sure to connect the external power supply to the appropriate terminals.

1. Remove the terminal block cover.
2. If a screw-type terminal block is installed, remove the screws from the appropriate terminals. Use these screws along with #6 ring lugs to secure the wires to the terminal block.
3. Connect the positive wire from the power source to the positive/live (+/L) terminal on the terminal block. For more information, refer to Section 2.2.3, “Wiring Examples”.

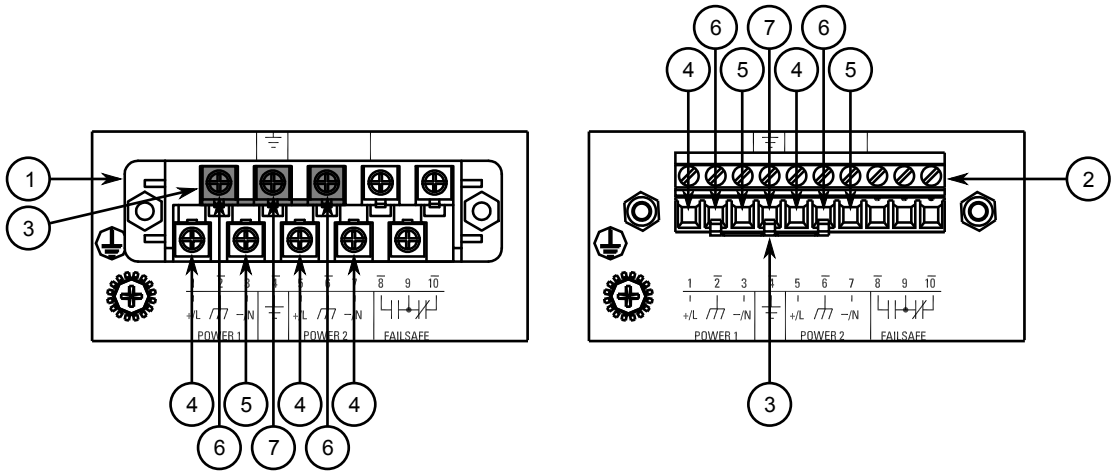

Figure 5: Terminal Block Wiring

1. Screw-Type Terminal Block **2.** Pluggable Terminal Block **3.** Jumper **4.** Positive/Live (+/L) Terminal **5.** Negative/Neutral (-/N) Terminal **6.** Surge Ground Terminal **7.** Chassis Ground Terminal

4. Connect the negative wire from the power source to the negative/neutral (-/N) terminal on the terminal block. For more information, refer to Section 2.2.3, “Wiring Examples”.
5. Install the supplied metal jumper between terminals 2, 4 and 6 to connect the surge ground terminals to the chassis ground terminal. The surge ground terminals are used as the ground conductor for all surge and transient suppression circuitry internal to the unit.
6. Connect the ground terminal on the power source to the chassis ground terminal on the device. For more information, refer to Section 2.4, “Grounding the Device”

DANGER!
Electrocution hazard – risk of death, serious personal injury and/or damage to the device. Make sure the supplied terminal block cover is always installed before the device is powered.

7. Install the terminal block cover.

Section 2.2.2
Connecting DC Power

To connect a high or low DC power supply to the device, do the following:

CAUTION!
Electrical hazard – risk of damage to equipment. Before testing the dielectric strength (HIPOT) in the field, remove the metal jumper. This metal jumper connects transient suppression circuitry to chassis ground and must be removed in order to avoid damage to transient suppression circuitry during testing.

NOTE
The terminal block is divided into separate terminals for each internal power supply. Make sure to connect the external power supply to the appropriate terminals.

NOTE
The screw-type terminal block is installed using Philips screws and compression plates, allowing either bare wire connections or crimped terminal lugs. Use #6 size ring lugs for secure, reliable screws, which must be removed to make connections.

1. Remove the terminal block cover.
2. If a screw-type terminal block is installed, remove the screws from the appropriate terminals. Use these screws along with #6 ring lugs to secure the wires to the terminal block.
3. Connect the positive wire from the power source to the positive/live (+/L) on the terminal block. For more information, refer to Section 2.2.3, “Wiring Examples”.

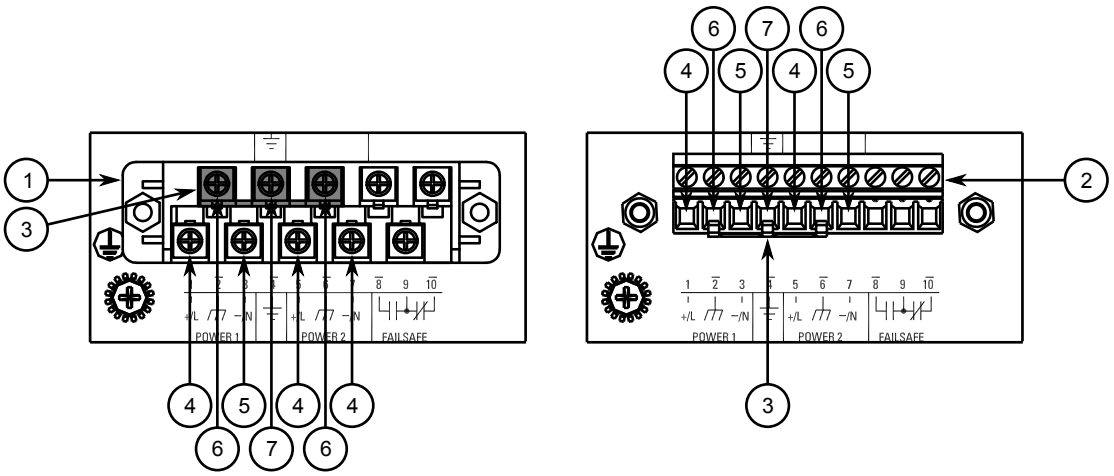

Figure 6: Terminal Block Wiring

1. Screw-Type Terminal Block **2.** Pluggable Terminal Block **3.** Jumper **4.** Positive/Live (+/L) Terminal **5.** Negative/Neutral (-/N) Terminal **6.** Surge Ground Terminal **7.** Chassis Ground Terminal

4. Connect the negative wire from the power source to the negative/neutral (-/N) on the terminal block. For more information, refer to Section 2.2.3, “Wiring Examples”.
5. Install the supplied metal jumper between terminals 2, 4 and 6 to connect the surge ground terminals to the chassis ground terminal. The surge ground terminals are used as the ground conductor for all surge and transient suppression circuitry internal to the unit.
6. Connect the ground terminal on the power source to the chassis ground terminal on the device. For more information, refer to Section 2.4, “Grounding the Device”

DANGER!
Electrocution hazard – risk of death, serious personal injury and/or damage to the device. Make sure the supplied terminal block cover is always installed before the device is powered.

7. Install the terminal block cover.

Section 2.2.3
Wiring Examples

The following illustrate how to connect power to single and dual power supplies.

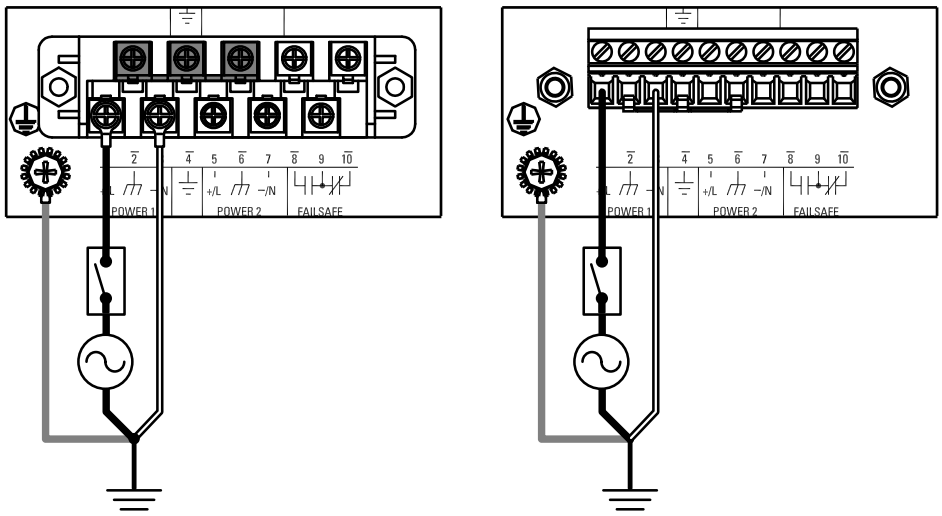

Figure 7: Single AC Power Supply

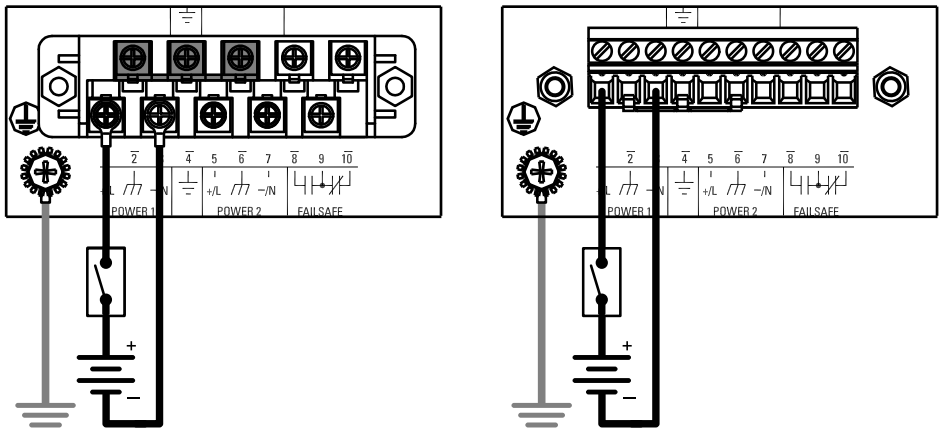

Figure 8: Single DC Power Supply

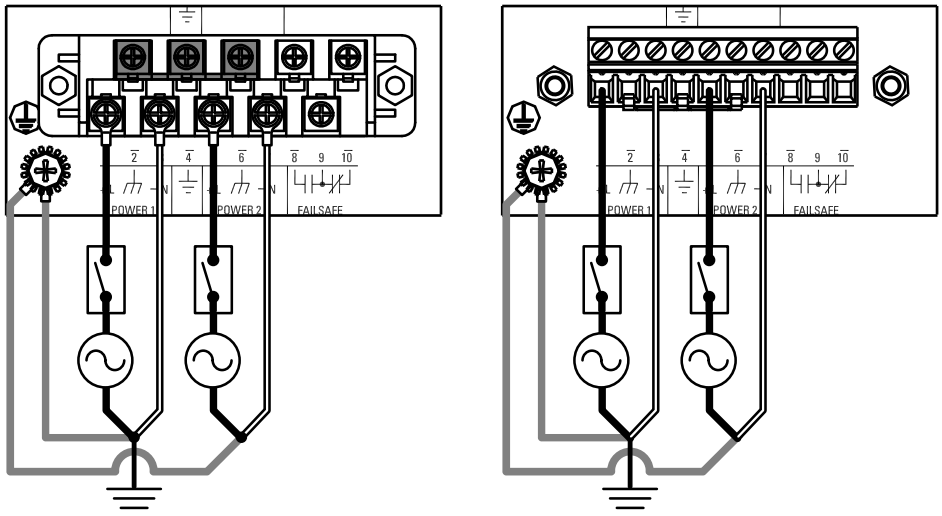

Figure 9: Dual AC Power Supply

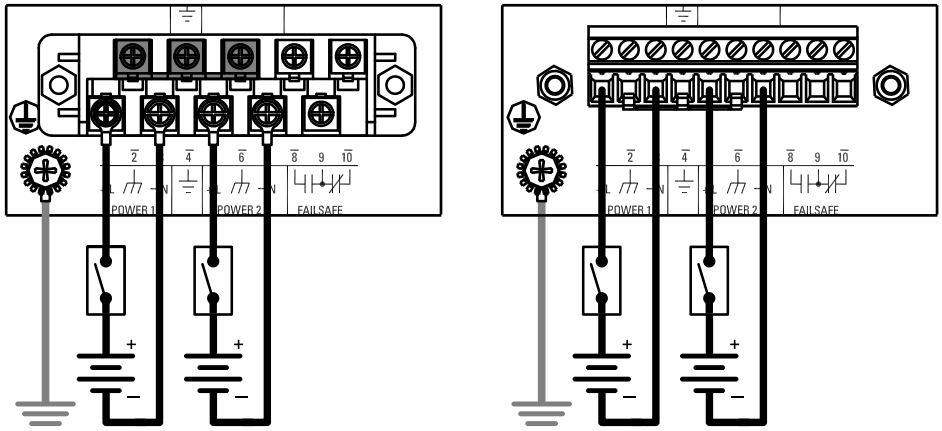

Figure 10: Dual DC Power Supply

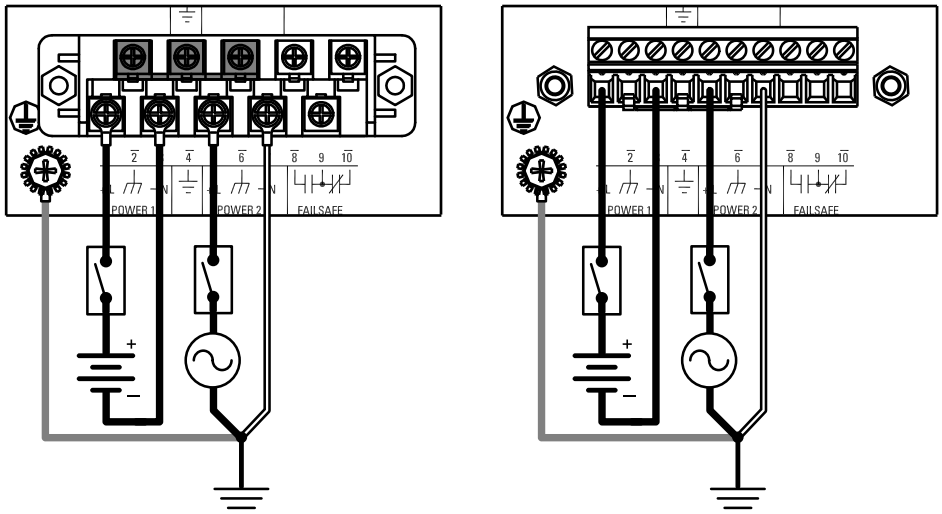

Figure 11: Dual AC/DC Power Supply

Section 2.3

Connecting the Failsafe Alarm Relay

The failsafe relay can be configured to latch based on alarm conditions. The NO (Normally Open) contact is closed when the unit is powered and there are no active alarms. If the device is not powered or if an active alarm is configured, the relay opens the NO contact and closes the NC (Normally Closed) contact.

NOTE
Control of the failsafe relay output is configurable through ROX. One common application for this relay is to signal an alarm if a power failure occurs. For more information, refer to the ROX User Guide for the RX1100.

The following shows the proper relay connections.

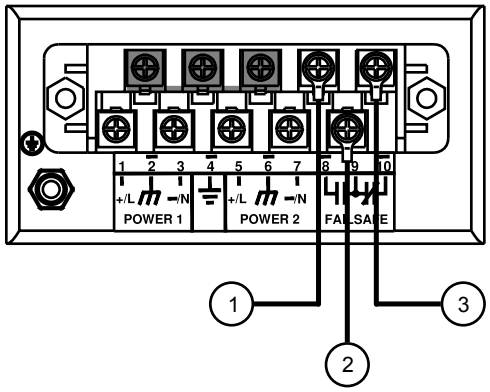

Figure 12: Failsafe Alarm Relay Wiring

1. Normally Open **2.** Common **3.** Normally Closed

Section 2.4

Grounding the Device

The RX1100 chassis ground terminal uses a #6-32 screw. It is recommended to terminate the ground connection with a #6 ring lug and torque it to 1.7 N·m (15 lbf·in).

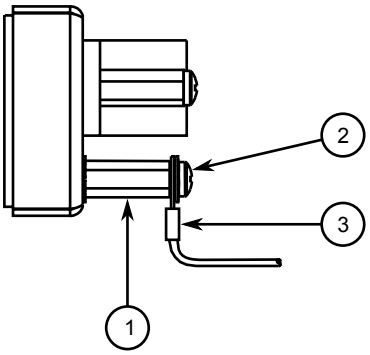

Figure 13: Chassis Ground Connection

1. Stainless Steel Stud **2.** #6-32 Screw **3.** #6 Ring Lug

Section 2.5

Cabling Recommendations

Siemens does not recommend the use of copper cabling of any length for critical, real-time substation automation applications. All copper Ethernet ports on RUGGEDCOM products include transient suppression circuitry to protect against damage from electrical transients and conform with IEC 61850-3 and IEEE 1613 Class 1 standards. This means that during a transient electrical event, communications errors or interruptions may occur, but recovery is automatic.

Siemens also does not recommend using copper Ethernet ports to interface with devices in the field across distances that could produce high levels of ground potential rise (i.e. greater than 2500 V), during line-to-ground fault conditions.

Section 2.6

Connecting to the Device

The following describes the various methods for accessing the ROX console and Web interfaces on the device. For more detailed instructions, refer to the *ROX User Guide* for the RX1100.

RS232 Console Port

Connect a PC or terminal directly to the RS232 console port to access the boot-time control and ROX interfaces. The console port provides access to ROX's console and Web interfaces.

IMPORTANT!
The console port is intended to be used only as a temporary connection during initial configuration or troubleshooting.

Connection to the console port is made using an RJ45-to-DB9 console cable. The following is the pin-out for the console port:

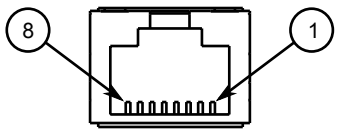

Figure 14: RJ45 Console Port Pin Configuration

Pin		Name	Description
RJ45 Male	DB9 Female		
1	6	DSR[a]	Data Set Ready
2	1	Reserved (Do Not Connect)	
3	4	DTR[a]	Data Terminal Ready
4	5	GND	Signal Ground
5	2	RxD	Receive Data (to DTE)
6	3	TxD	Transmit Data (from DTE)
7	8	CTS[b]	Clear to Send
8	7	RTS[b]	Read to Send
1	9	RI[c]	Ring Indicator

[a] *The DSR, DCD and DTR pins are connected together internally.*

[b] *The CTS and RTS pins are connected together internally.*

[c] *RI is not connected.*

Communication Ports

Connect any of the available Ethernet ports on the device to a management switch and access the ROX console and Web interfaces via the device's IP address. For more information about available ports, refer to Chapter 3, *Communication Ports*.

3 Communication Ports

The RX1100 can be equipped with various types of communication ports to enhance its abilities and performance. To determine which ports are equipped on the device, refer to the factory data file available through ROX. For more information on how to access the factory data file, refer to the *ROX User Guide* for the RX1100.

Each communication port type has a specific place in the RX1100 chassis.

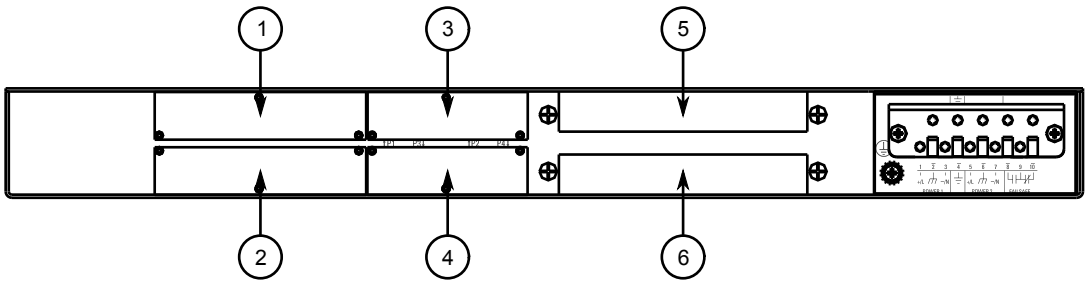

Figure 15: Port Assignment

1. Slot 1 **2.** Slot 2 **3.** Slot 3 **4.** Slot 4 **5.** Slot 5 **6.** Slot 6

Slot(s)	Communication Port
1	GSM/EDGE cellular modem
1, 2	V.90 modem RS232 external modem
3, 4	Copper 10/100Base-Tx Ethernet with RJ45 ports Fiber 100Base-FX multi-mode or single-mode Ethernet with ST, SC, LC or MTRJ ports
5, 6	Single T1/E1 Channelized/Unchannelized Dual T1/E1 Channelized/Unchannelized Quad T1/E1 Channelized/Unchannelized Clear Channel T3 DS3 card DSL card 56 kBbps DDS DSU/CSU card Precision Time Protocol (PTP) card Serial RS232/RS422/RS485 card with RJ45 ports Synchronous dual serial card with DB25 ports GSM/EDGE/HSPA cellular modem EVDO Rev.A Verizon (US) wireless cellular modem

The following sections describe the available ports in more detail:

- Section 3.1, “Copper Ethernet Ports”
- Section 3.2, “Fiber Optic Ethernet Ports”
- Section 3.3, “WAN Ports”

Section 3.1

Copper Ethernet Ports

The RX1100 supports several 10/100Base-TX Ethernet ports that allow connection to standard Category 5 (CAT-5) unshielded twisted-pair (UTP) cables with RJ45 male connectors. The RJ45 connectors are directly connected to the chassis ground on the device and can accept CAT-5 shielded twisted-pair (STP) cables.

Each port features a **Speed** and **Link** LED that indicates the state of the port.

LED	State	Description
Speed	Yellow	The port is operating at 100 Mbps
	Off	The port is operating at 10 Mbps
Link	Yellow (Solid)	Link established
	Yellow (Blinking)	Link activity
	Off	No link detected

The following is the pin-out for the RJ45 male connector:

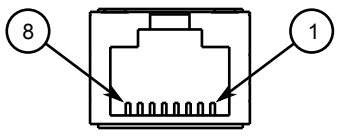

Figure 16: RJ45 Ethernet Port Pin Configuration

Pin	Name	Description
1	RX+	Receive Data+
2	RX-	Receive Data-
3	TX+	Transmit Data+
4	Reserved (Do Not Connect)	
5	Reserved (Do Not Connect)	
6	TX-	Transmit Data-
7	Reserved (Do Not Connect)	
8	Reserved (Do Not Connect)	

For specifications on the available copper Ethernet ports, refer to Section 4.3, “Copper Ethernet Port Specifications”.

Section 3.2

Fiber Optic Ethernet Ports

Fiber optic Ethernet ports are available with either MTRJ (Mechanical Transfer Registered Jack), LC (Lucent Connector), SC (Standard or Subscriber Connector) or ST (Straight Tip) connectors. Make sure the Transmit (Tx) and Receive (Rx) connections of each port are properly connected and matched to establish a proper link.

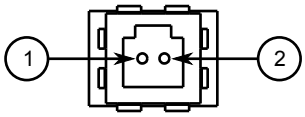

Figure 17: MTRJ Port

1. Tx Connector **2.** Rx Connector

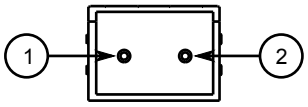

Figure 18: LC Port

1. Tx Connector **2.** Rx Connector

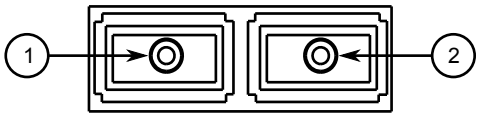

Figure 19: SC Port

1. Tx Connector **2.** Rx Connector

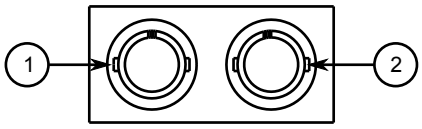

Figure 20: ST Port

1. Tx Connector **2.** Rx Connector

For specifications on the available fiber optic Ethernet ports, refer to Section 4.4, “Fiber Ethernet Port Specifications”.

Section 3.3

WAN Ports

The RX1100 can optionally be equipped with T1/E1 WAN ports, which communicate on standard telephony communication lines.

T1/E1 WAN ports are equipped with standard RJ45 receptacles. The following is the pin-out for the T1/E1 ports:

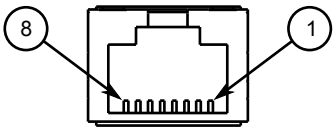

Figure 21: RJ45 T1/E1 Port Pin Configuration

Pin	Description
1	RRING
2	RTIP
3	Reserved (Do Not Connect)
4	TRING
5	TTIP
6	Reserved (Do Not Connect)
7	Reserved (Do Not Connect)
8	Reserved (Do Not Connect)

Section 3.4
DSL Ports

The RX1100 can optionally be equipped with a dual-port DSL (Digital Subscriber Line) card, which can communicate over standard telephone communication lines. The DSL card supports the following modulation standards:

- G.992.1 (G.DMT)
- G.992.2 (G.Lite)
- G.992 Annex A (ADSL over POTS)

Each DSL card is equipped with standard RJ11 telephone ports. The following is the pin-out description for the RJ11 ports:

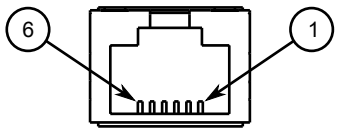

Figure 22: RJ11 Port Port Pin Configuration

Pin	Description
1	Reserved (Do Not Connect)
2	Reserved (Do Not Connect)
3	Ring
4	Tip
5	Reserved (Do Not Connect)
6	Reserved (Do Not Connect)

Section 3.5
DDS Ports

The RX1100 can optionally be equipped with a 56/64 kbps DDS (Data Distribution Service) card that uses standard RJ45 receptacles.

The following is the pin-out for the DDS ports:

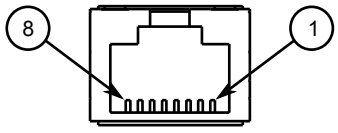

Figure 23: DDS RJ45 Port Pin Configuration

Pin	Name	Description
1	R1	Transmit data to network (Ring 1)
2	T1	Transmit data to network (Tip 1)
3	Reserved (Do Not Connect)	
4	Reserved (Do Not Connect)	
5	Reserved (Do Not Connect)	
6	Reserved (Do Not Connect)	
7	T	Receive data from network (Tip)
8	R	Receive data from network (Ring)

Section 3.6
Modem Port

The RX1100 can optionally be equipped with a V.90 Modem connection for PPP (Point-to-Point Protocol) connections. For information about how to configure and operate the modem, refer to the *ROX User Guide* for the RX1100.

WARNING!
Fire hazard – risk of serious personal injury and/or damage to equipment. To reduce the risk of fire, use only #26 AWG or larger telecommunication line cord.

The modem card is equipped with a standard RJ11 telephone port. The following is the pin-out description for the RJ11 port:

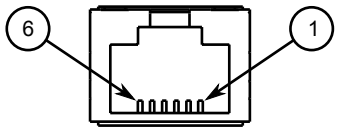

Figure 24: RJ11 Port Pin Configuration

Pin	Description
1	Reserved (Do Not Connect)
2	Reserved (Do Not Connect)
3	Ring
4	Tip
5	Reserved (Do Not Connect)
6	Reserved (Do Not Connect)

NOTE
This product meets the applicable Industry Canada technical specifications.

The Ringer Equivalence Number is an indication of the maximum number of devices allowed to be connected to a telephone interface. The termination on an interface may consist of any combination of devices subject only to the requirement that the sum of the RENs of all the devices does not exceed five.

Section 3.7
Serial Ports

The RX1100 supports serial cards with DB25 or RJ45 serial ports. Serial RJ45 ports can be run in RS232, RS485 or RS422 mode.

NOTE
On power-up, all serial RJ45 ports default to RS485 mode. Each port can be individually set to RS232, RS485 or RS422 mode through ROX. For more information, refer to the ROX User Guide for the RX1100.

NOTE
For information about how to connect devices configured to run in RS485 mode, refer to Section 3.11, "Connecting Multiple RS485 Devices".

All serial ports feature an LED that indicates the current state of the port.

State	Description
Green	Link activity detected
Off	No link detected

For specifications on serial ports, refer to Section 4.5, “Serial Port Specifications”.

The following is the pin-out description for DB25 and RJ45 serial ports:

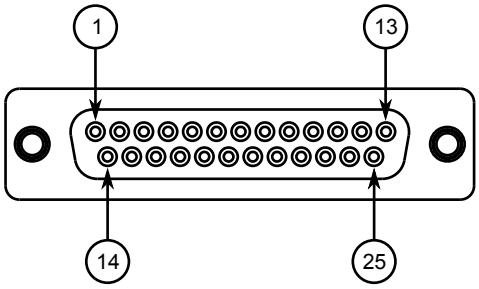

Figure 25: Serial DB25 Port Pin Configuration

Pin	Name	Description
1		
2	TxD	Transmit Data
3	RxD	Receive Data
4	RTS	Request To Send
5	CTS	Clear To Send
6		
7	GND	Common Ground
8	DCD	Carrier Detect
9		
10		
11		
12		
13		
14		
15	TxCLK	Transmit Clock
16	RxCLK	Receive Clock
17		
18		
19		
20	DTR	Data Terminal Ready
21		
22		
23		
24		
25		

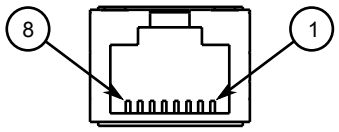

Figure 26: Serial RJ45 Port Pin Configuration

Pin	RS232 Mode	RS485 Mode	RS422 Mode
1[a]	DSR/RI		RX-
2[a]	DCD		
3	DTR		
4	Common (Isolated) Ground		
5	RX		RX+
6	TX	TX/RX+	TX+
7	CTS[ab]		
8	RTS[b]	TX/RX-	TX-
Shield	Chassis Ground		

[a] *Connected internally.*

[b] *In RS232 mode, this pin enters a high impedance state. A DTE that asserts RTS will see CTS asserted, although the device will not perform hardware flow control.*

Section 3.8

Precision Time Protocol (PTP) Ports

The optional Precision Time Protocol (PTP) card for the RX1100 provides accurate time synchronization across local and wide area networks. The PTP card is capable of using a variety of time synchronization methods including Network Time Protocol (NTP), IRIG-B, and IEEE 1588, making it a flexible product for new and existing installations.

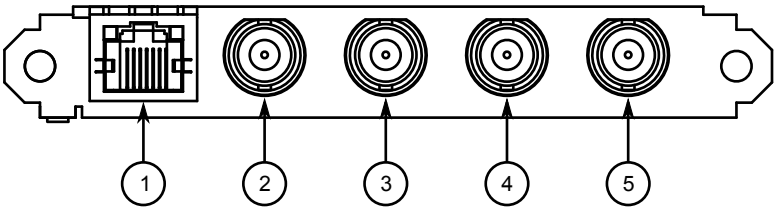

Figure 27: PTP Card

1. IEEE 1588 Ethernet Interface **2.** GPS Antenna Input **3.** IRIG-B AM Output **4.** IRIG-B PWM (TTL) or PPS Output 1 **5.** IRIG-B PWM (TTL) or PPS Output 2

NTP is the standard for synchronizing the clocks of computer systems throughout the Internet and is suitable for systems that require accuracies in the order of 1 ms. IRIG-B time synchronization relies on the Global Positioning System (GPS) as the source of accurate time and requires an external GPS antenna input to provide accurate time signals on the order of 100 µs. IEEE 1588 is designed to fill a niche not well served by either of the two dominant protocols, NTP and IRIG-B. IEEE 1588 is designed for local systems requiring accuracies on the order of 100 nanoseconds. IEEE 1588 is also designed for applications that cannot bear the cost of a GPS receiver at each node or for which GPS signals are inaccessible.

The PTP card is an ideal product for use in existing installations already well served by NTP and/or GPS. It also provides a migration path for the use of the new IEEE 1588 standard. As more end devices enter the market with IEEE 1588 compatibility, this card provides an easy transition to this new time synchronization standard.

The following sections describe the PTP card in more detail:

- Section 3.8.1, “IRIG-B Outputs”
- Section 3.8.2, “Pulse-Per-Second (PPS) Output”
- Section 3.8.3, “GPS Antenna Installation Recommendations”

Section 3.8.1
IRIG-B Outputs

The PTP Card supports both IRIG-B outputs in both Amplitude Modulated (AM) and Pulse Width Modulation (PWM) formats. Specifically, for the AM output, IRIG-B122 and IRIG-B123 are supported. For the PWM output, IRIG-B002 and IRIG-B003 are supported. Enabling of the AM and PWM outputs is done through software.

The number of IRIG-B devices that can be connected to the AM or PWM source is dependent on the cabling type and length as well as the input impedances of the devices. Figure 16 shows a simplified circuit diagram of the interface between the IRIG-B source and connected devices.

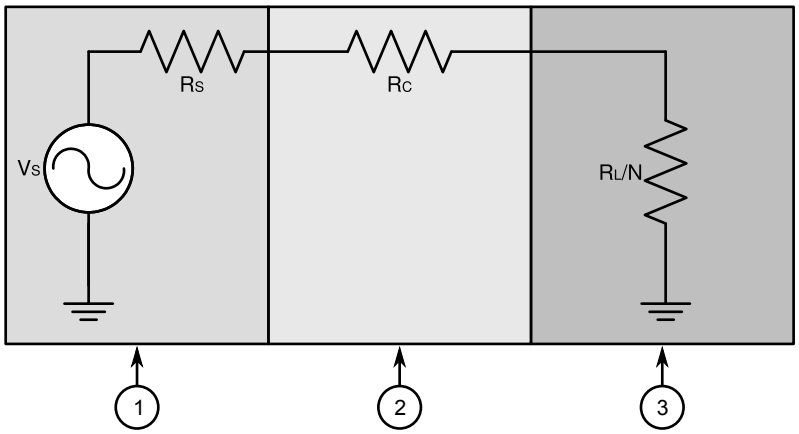

Figure 28: IRIG-B Simplified Schematic

1. Source **2.** Cabling **3.** Device

The maximum number of devices (N) that can be connected to the source is determined by checking if the source current (IS) required to drive the connected devices is less than the maximum drive current the source can provide, and verifying that the load voltage (VL) the connected devices see is greater than the minimum required voltage.

For specifications for the IRIG-B outputs, refer to Section 4.6, “IRIG-B Output Specifications”.

Section 3.8.2
Pulse-Per-Second (PPS) Output

The PTP card supports one Pulse-Per-Second (PPS) output. When enabled through ROX, the card outputs a 5 V pulse every second.

Section 3.8.3

GPS Antenna Installation Recommendations

The signals received from the GPS satellite network are at a frequency of 1575.42 MHz with a minimum power of -162 dBW. The GPS antenna must have a clear view of the sky in order to receive the low power signals and track the maximum number of satellites. Rooftops or other structures clear of obstructions and with a clear view of the horizon are ideal.

Elements of a typical GPS antenna system include:

- Active GPS Antenna (required)
- Coaxial cable to connect the elements (required)
- Lightning arrestor (optional)
- Line Amplifier or Filter (optional)

To establish proper GPS signal reception, the overall system of antenna, cabling, lightning arrestor, line amplifier and filters requires a relative gain which should be greater than 5 dBi but less than 18 dBi (to avoid signal saturation at the receiver input).

The following sections describe each component in the GPS antenna system in more detail:

- Section 3.8.3.1, “GPS Antenna”
- Section 3.8.3.2, “Antenna Cabling”
- Section 3.8.3.3, “Lightning Considerations”
- Section 3.8.3.4, “Line Amplification and Filtering”

Section 3.8.3.1

GPS Antenna

There are two major types of GPS antenna: passive and active. A passive antenna requires no power and is an option when signal strength is not a concern. An active antenna has a built in Low Noise Amplifier (LNA) to increase the strength of the signal, and to compensate for the signal loss in a long cable connection. Active antennas are used when the antenna input is connected to the receiver through a coaxial cable (usually longer than 3 m) or any high loss transmission path.

NOTE

- *The PTP card’s GPS input provides 5 VDC at up to 10 mA to power the antenna.*
- *Best results can be achieved with a total gain of 16 dB (includes antenna gain, cable loss, lightning arrestor loss, line amplifier gain and filter loss) at the antenna input.*

The PTP Card requires an active antenna with the following specifications:

Characteristic	Active Antenna
Polarization	Right-Hand Circular Polarized
Receive Frequency	1.57542 GHz ± 1.023 MHz
Power Supply	5 VDC
DC Current	< 10 mA at 3 VDC
Antenna Gain	Select antenna gain based on system configuration

Characteristic	Active Antenna
Total Gain at PTP GPS Input (includes antenna gain, cable loss, lightning arrestor loss, line amplifier gain and filter loss)	Total Gain ≤ 18 dBi
Axial Ratio	< 3 dB
Output VSWR	< 2.5

Section 3.8.3.2
Antenna Cabling

Cable Impedance: Siemens recommends low loss 50 Ω coaxial cabling.

Cable Delay: Using any length of coaxial cable will add some time delay to the GPS signal which degrades the accuracy of the calculated time and position. The time delay is dependent on the type of dielectric material in the cable and ranges from 1 to 2 ns/ft. Siemens provides a method to account for this delay through the web management interface by entering the time delay into the cable compensation box under PTP General Configuration. The table below gives some examples of the delay that can be expected based on the dielectric type.

Dielectric Type	Time Delay(ns/ft)	PropagationVelocity(% of c)
Solid Polyethylene (PE)	1.54	65.9
Foam Polyethylene (FE)	1.27	80.0
Foam Polystyrene (FS)	1.12	91.0
Air Space Polyethylene (ASP)	1.15-1.21	84-88
Solid Teflon (ST)	1.46	69.4
Air Space Teflon (AST)	1.13-1.20	85-90

Section 3.8.3.3
Lightning Considerations

Although it is not possible to protect the antenna from a direct lighting strike, the antenna and connected components can be protected from secondary affects through installation location and protection devices.

Install the antenna at least 15 meters away from and lower than any structures that attract lightning. GPS antenna damage is usually not the result of a direct lightning strike, but due to high currents induced by the effects of a lightning strike on a nearby structure. Siemens also recommends installing lightning arrestors in the antenna line to protect the receiver and connected devices. If a lightning arrestor is installed it is important to ensure that it has a low impedance path to ground.

Section 3.8.3.4
Line Amplification and Filtering

Although an active antenna has gain, depending on the length of the coaxial cable used it may not be enough in which case a line amplifier will be required as well.

Most active antennas include filters. However, if there is a high potential for electromagnetic interference, such as from the near field of a radio transmitter, though the antenna system, additional antenna line filtering may be necessary.

Section 3.9
RS232 External Modem Ports

The optional RS232 external modem card provides all of the handshaking signals required to control an external modem via a female DB9 connector.

The following is the pin-out for DB9 ports operating in RS232 mode:

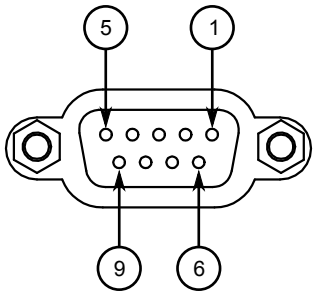

Figure 29: Serial DB9 Port Pin Configuration

Pin	Name	Description
1	CD	Carrier Detect
2	RxD	Receive data
3	TxD	Transmit Data
4	DTR	Data Terminal Ready
5	GND	Common Ground
6	DSR	Data Set Ready
7	RTS	Request To Send
8	CTS	Clear To Send
9	RI (No Connection)	Ring Indicator

NOTE
Although a DB9 RS232 DTE (Data Terminal Equipment) connector is ordinarily male, the female connector has been used here for reasons of durability (i.e. there are no pins to bend). Use a commonly available male-to-male DB9 adapter (not a NULL-modem) to adapt this connection to a standard straight-through RS232 cable.

Section 3.10
Cellular Modems

The RX1100 supports the following cellular modem line modules for operation on GSM, EDGE, HSPA+, or CDMA networks:

NOTE
The cellular modems feature 50 Ω SMA antenna connectors on the front plate of each module.

The HSPA option is available for use on various GSM-based networks. This option supports GSM, GPRS, EDGE, UMTS and WCDMA/HSDPA/HSUPA. The Main antenna and Receive Diversity antenna connections are made to the 50 Ω SMA connectors.

The following sections describe the cellular modem modules in more detail:

Section 3.10.1
EVDO Cellular Modem

The EVDO dual band card option is offered for use on Verizon's cellular network. The radio supports IS-95A, 1xRTT, 1xEVDO Rev0 and 1xEVDO RevA, and will automatically select the fastest mode available when a data call is made. Main antenna and Receive Diversity antenna connections are made to the 50 Ω SMA connectors located on the front faceplate.

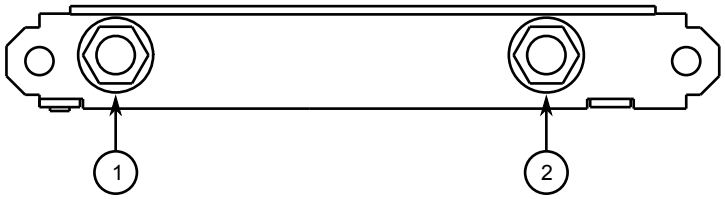

Figure 30: EVDO Cellular Modem

The EVDO cellular modem has the following minimum requirements:

Band	Frequency Range (MHz)		VSWR	RX Diversity Support	Maximum Allowable Gain (dBi)
	Tx	Rx			
Cell	824-849	869-894	<2:1	<2:1	4.95
PCS	1850-1910	1930-1990			3.55

Contact Verizon for information about account activation.

Section 3.10.2
HSPA (GSM) Cellular Modem

The HSPA card option is available for use on various GSM-based networks. The card supports GSM, GPRS, EDGE, UMTS and WCDMA/HSDPA/HSUPA. The Main and Receive Diversity antenna connections are made to the 50 Ω SMA connectors located on the front faceplate.

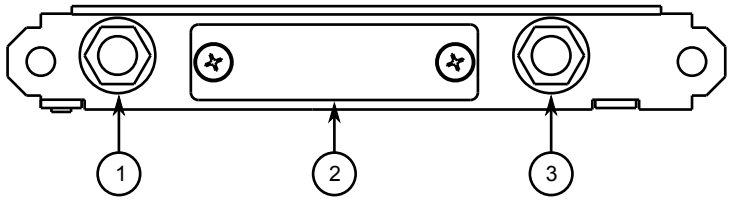

Figure 31: HSPA Cellular Modem

1. Receive Diversity Antenna SMA Connector **2.** Access Panel **3.** Main Antenna SMA Connector

Installing a SIM Card

SIM card access is available on the front faceplate of the HSPA module. Follow these steps to install a SIM card:

1. Disconnect power from the device.
2. Remove the protective cover marked *HSPA*.
3. Insert the SIM card with the angled side first. An audible click will indicate the SIM card is in position.
4. Slide the latch over the SIM card to secure it in place.
5. Install the protective cover.
6. Connect power to the device.

Supported Frequency Bands

WARNING!
Electromagnet radiation hazard – risk of serious injury. Do not exceed the maximum antenna gain. Aside from causing cellular interference for other devices that use the same band, adverse health effects for individuals in the area may occur.

Band	Frequency Range				RX Diversity Support	Maximum Allowable Gain (dBi)
	Tx (MHz)	VSWR	Rx (MHz)	VSWR		
Band I WCDMA 2100	1920-1980	<2.5:1	2110-2170	<3.5:1	Y	4
Band II WCDMA 1900	1850-1910	<2.5:1	1930-1990	<2.5:1	Y	4
Band V WCDMA 850	824-849	<2.5:1	869-894	<3.5:1	Y	5
Band VI WCDMA 800	830-840	<2.5:1	875-885	<3.5:1	Y	5
GSM 850	824-849	<2.5:1	869-894	<3.5:1		5
EGSM 900	880-915	<2.5:1	925-960	<3.5:1		5
GSM 1800	1710-1785	<2.5:1	1805-1880	<3.5:1		4
GSM 1900	1850-1910	<2.5:1	1930-1990	<2.5:1		4

Section 3.10.3

GSM/EDGE Internal Cellular Modem

The GSM/EDGE internal cellular modem option is available for use on various GSM-based networks. The card supports GSM and EDGE. The single antenna connection is made to the 50 Ω SMA connector located on the front faceplate.

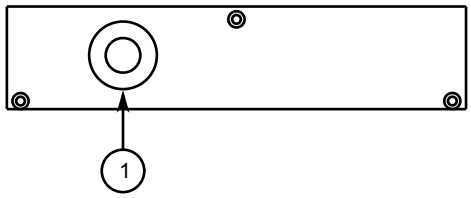

Figure 32: GSM/EDGE Internal Cellular Modem

1. SMA Connector

Installing a SIM Card

The SIM card is accessed through the access panel on top of the RX1100. To install a SIM card, follow these steps:

1. Disconnect power from the device.
2. Remove the access panel.
3. Insert the SIM card with the angled side first. An audible click will indicate the SIM card is in position.
4. Install the access panel.
5. Connect power to the device.

Supported Frequency Bands

WARNING!
Electromagnet radiation hazard – risk of serious injury. Do not exceed the maximum antenna gain. Aside from causing cellular interference for other devices that use the same band, adverse health effects for individuals in the area may occur.

Band	Frequency Range				Maximum Allowable Gain (dBi)
	Tx (MHz)	VSWR	Rx (MHz)	VSWR	
GSM 850	824-849	<2.5:1	869-894	<3.5:1	5
EGSM 900	880-915	<2.5:1	925-960	<3.5:1	5
GSM 1800	1710-1785	<2.5:1	1805-1880	<3.5:1	4
GSM 1900	1850-1910	<2.5:1	1930-1990	<2.5:1	4

Section 3.11

Connecting Multiple RS485 Devices

Each RS485 port can communicate with multiple RS485 devices by wiring devices together in sequence over a single twisted pair with transmit and receive signals on the same two wires (half duplex). For reliable, continuous communication, adhere to the following guidelines:

- To minimize the effects of ambient electrical noise, use shielded cabling.
- The correct polarity must be observed throughout a single sequence or ring.
- The number of devices wired should not exceed 32, and total distance should be less than 1219 m (4000 ft) at 100 kbps.
- The Common terminals should be connected to the common wire inside the shield.
- The shield should be connected to earth ground at a single point to avoid loop currents.
- The twisted pair should be terminated at each end of the chain.

The following shows the recommended RS485 wiring.

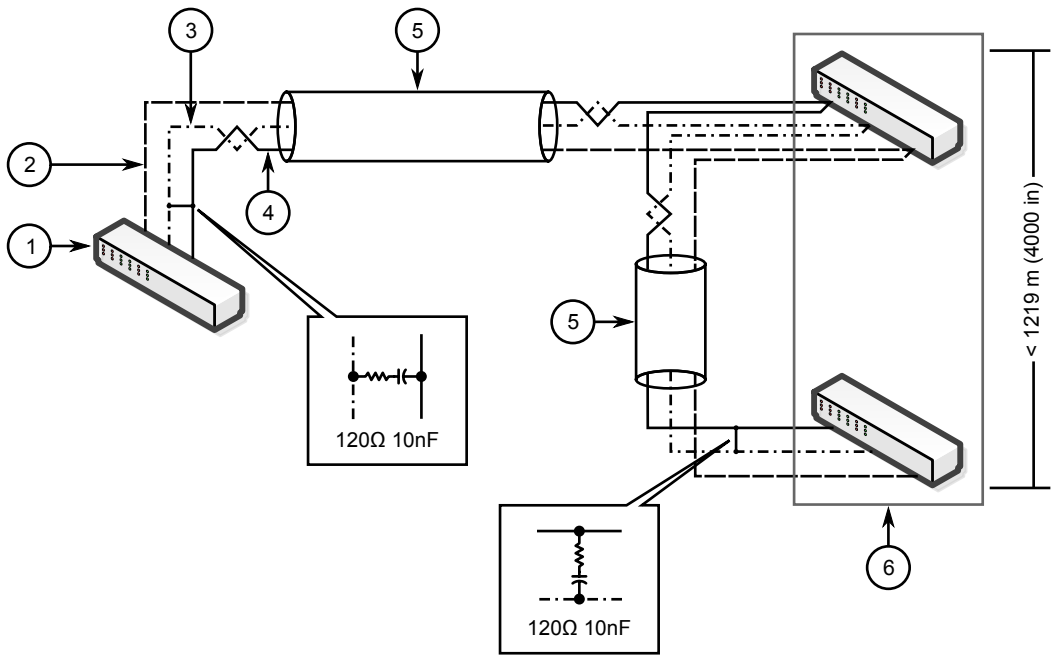

Figure 33: Recommended RS485 Wiring

1. RX1100 Device **2.** Common (Isolated Ground) **3.** Negative **4.** Positive **5.** Shield to Earth (Connected At a Single Point)
6. RS485 Devices (32 Total)

4 Technical Specifications

The following sections provide important technical specifications related to the device and available modules:

Section 4.1

Power Supply Specifications

Power Supply Type	Input Range		Internal Fuse Rating[ab]	Isolation	Maximum Power Consumption[c]
	Minimum	Maximum			
12 VDC	10 VDC	36 VDC	6.3 A(F)	1.5 kVDC	25 W
24 VDC					
48 VDC	36 VDC	59 VDC	3.15 A(T)		
HI (125/250 VDC)[d]	88 VDC	300 VDC	2 A(T)	4 kVAC, 5.5 kVDC	
HI (110/230 VAC)[d]	85 VAC	264 VAC			

[a] *(F) denotes fast-acting fuse*

[b] *(T) denotes time-delay fuse.*

[c] *Power consumption varies based on configuration. 10/100Base-TX ports consume roughly 1 W less than fiber optic ports.*

[d] *The HI power supply is the same power supply for both AC and DC.*

Section 4.2

Failsafe Relay Specifications

Parameter	Value (Resistive Load)
Max Switching Voltage	30 VAC, 80 VDC
Rated Switching Current	0.3 A @ 30 VAC 1 A @ 30 VDC, 0.3 A @ 80 VDC

Section 4.3
Copper Ethernet Port Specifications

The following details the specifications for copper Ethernet ports that can be ordered with the RX1100.

Speed[e]	Connector	Duplex[e]	Cable Type[f]	Wiring Standard[g]	Maximum Distance[h]	Isolation[i]
10/100Base-TX	RJ45	FDX/HDX	> CAT-5	TIA/EIA T568A/B	100 m (328 ft)	1.5 kV

[e] *Auto-negotiating.*

[f] *Shielded or unshielded.*

[g] *Auto-crossover and auto-polarity.*

[h] *Typical distance. Dependent on the number of connectors and splices.*

[i] *RMS 1 minute.*

Section 4.4
Fiber Ethernet Port Specifications

The following details the specifications for fiber Ethernet ports that can be ordered with the RX1100.

NOTE
Order codes are contained within each product when assembled and configured at the factory. Refer to the ROX User Guide for the RX1100 for information on how to obtain the factory configuration data.

NOTE
- *All optical power numbers are listed as dBm averages. To convert from average to peak add 3 dBm. To convert from peak to average, subtract 3 dBm.*
- *Maximum segment length is greatly dependent on factors such as fiber quality, and the number of patches and splices. Consult a Siemens sales associate when determining maximum segment distances.*

Mode	Connector Type	Cable Type (µm)	Tx λ (typ.) (nm)	Tx min. (dBm)	Tx max. (dBm)	Rx Sensitivity (dBm)	Rx Saturation (dBm)	Distance (typ.) (km)	Power Budget (dB)
MM	ST	62.5/125	1300	-19	-14	-31	-14	2	12
		50/125		-22.5					8.5
MM	SC	62.5/125	1300	-19	-14	-31	-14	2	12
		50/125		-22.5					8.5
MM	MTRJ	62.5/125	1300	-19	-14	-31	-14	2	12
SM	ST	9/125	1300	-15	-8	-32	-3	20	17
SM	SC	9/125	1300	-15	-8	-31	-7	20	16
SM	LC	9/125	1300	-15	-8	-34	-7	20	19
SM	SC	9/125	1300	-5	0	-34	-3	50	29

Mode	Connector Type	Cable Type (µm)	Tx λ (typ.) (nm)	Tx min. (dBm)	Tx max. (dBm)	Rx Sensitivity (dBm)	Rx Saturation (dBm)	Distance (typ.) (km)	Power Budget (dB)
SM	LC	9/125	1300	-5	0	-35	3	50	30
SM	SC	9/125	1300	0	5	-37	0	90	37
SM	LC	9/125	1300	0	5	-37	0	90	37
MM	LC	50/125	1300	-22.5	-14	-31	-14	2	8.5

Section 4.5
Serial Port Specifications

Baud Rate	Connector	Isolation
300 to 230 kbps	RJ45	2.5 kV
	DB25	

Section 4.6
IRIG-B Output Specifications

Parameter	Typical Value
Output Current (IS)	40 mA total between two output ports
Output Voltage (VS)	5 Vp-p
Output Impedance (RS)	25 Ω

Section 4.7
Operating Environment

Parameter	Range	Comments
Ambient Operating Temperature	-40 to 85 °C (-40 to 185 °F)	Measured from a 30 cm (12 in) radius surrounding the center of the enclosure.
Ambient Relative Humidity	5% to 95%	Non-condensing
Ambient Storage Temperature	-40 to 85 °C (-40 to 185 °F)	

Section 4.8

Mechanical Specifications

Parameter	Value
Dimensions	Refer to Chapter 5, *Dimension Drawings*
Weight	10 lb (4.5 Kg)
Ingress Protection	IP40
Enclosure	18 AWG galvanized steel

5 Dimension Drawings

NOTE
All dimensions are in millimeters, unless otherwise stated.

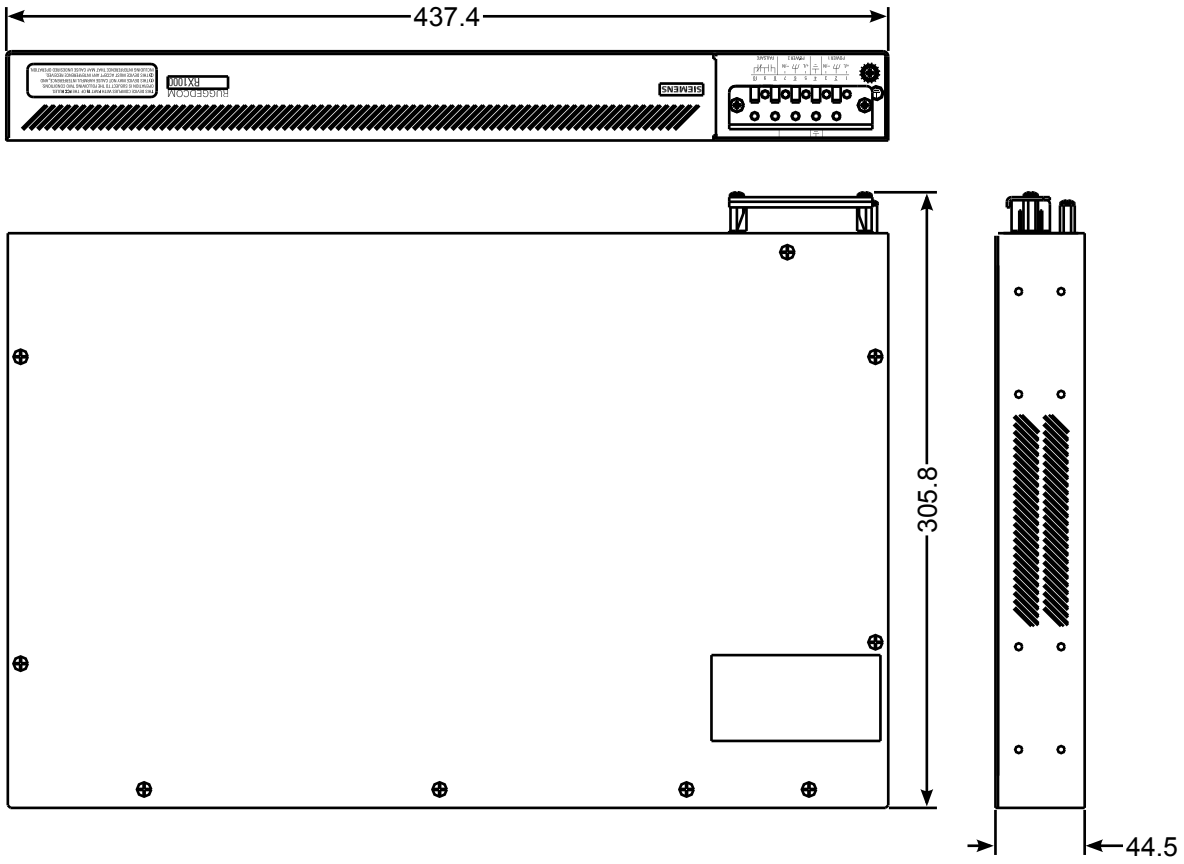

Figure 34: Overall Dimensions

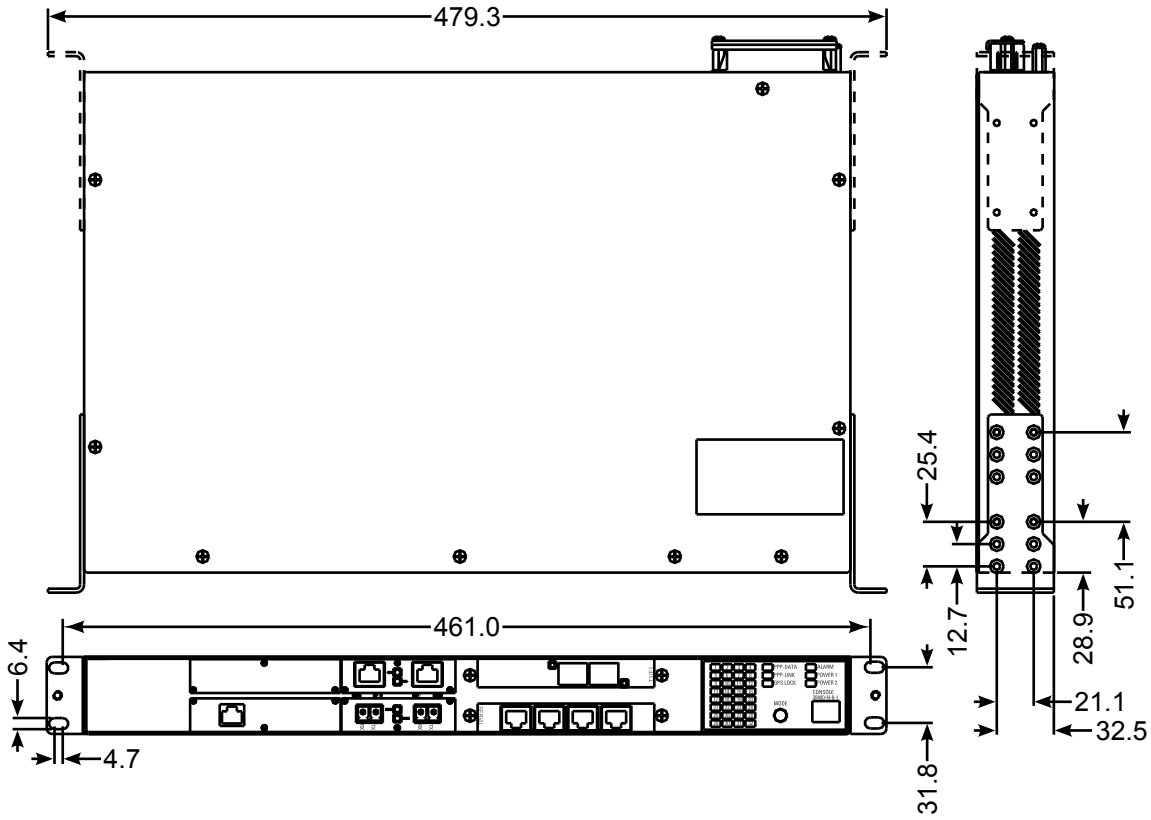

Figure 35: Rack Mount Dimensions

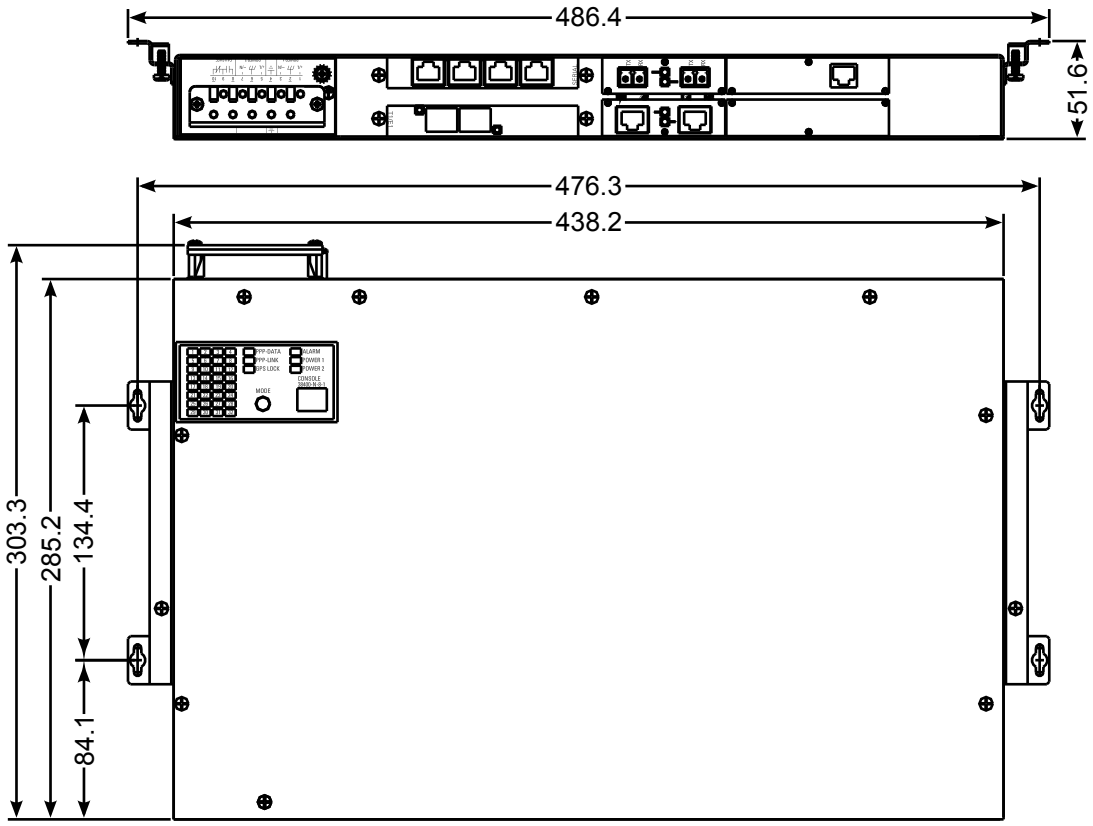

Figure 36: Panel and DIN Rail Mount Dimensions

6 Certification

The RX1100 device has been thoroughly tested to guarantee its conformance with recognized standards and has received approval from recognized regulatory agencies.

Section 6.1

Agency Approvals

Agency	Standards	Comments
CSA	CSA C22.2 No. 60950-1, UL 60950-1	Approved
CE	EN 60950-1, EN 61000-6-2, EN 55022, EN 60825-1, EN 50581	CE Compliance is claimed via Declaration of Self Conformity Route
FCC	FCC Part 15, Class A	Approved
FDA/CDRH	21 CFR Chapter I, Sub-chapter J	Approved

Section 6.2

FCC Compliance

This equipment has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment.

This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference on his own expense.

Section 6.3

Industry Canada Compliance

CAN ICES-3 (A) / NMB-3 (A)

Section 6.4

EMI and Environmental Type Tests

The RX1100 has passed the following EMI and environmental tests.

IEC 61850-3 EMI Type Tests

NOTE

- *In the case of an all fiber port configuration, this product meets all Class 2 requirements. Otherwise, all Class 1 requirements are met for copper ports.*
- *If the unit contains copper ports, the IEC 1613 conformance is Class 1, during which disturbance errors may occur but recovery is automatic.*
- *If the unit contains all fiber ports, the IEC 1613 conformance is Class 2, during which no disturbance errors will occur.*

Test	Description		Test Levels	Severity Levels
IEC 61000-4-2	ESD	Enclosure Contact	+/- 8 kV	4
		Enclosure Air	+/- 15 kV	4
IEC 61000-4-3	Radiated RFI	Enclosure ports	20 V/m	Note[a]
IEC 61000-4-4	Burst (Fast Transient)	Signal ports	+/- 4 kV @ 2.5 kHz	Note[b]
		DC Power ports	+/- 4 kV	4
		AC Power ports	+/- 4 kV	4
		Earth ground ports[c]	+/- 4 kV	4
IEC 61000-4-5	Surge	Signal ports	+/- 4 kV line-to-earth, +/- 2 kV line-to-line	4
		DC Power ports	+/- 2 kV line-to-earth, +/- 1 kV line-to-line	3
		AC Power ports	+/- 4 kV line-to-earth, +/- 2 kV line-to-line	4
IEC 61000-4-6	Induced (Conducted) RFI	Signal ports	10 V	3
		D.C Power ports		
		AC Power ports		
		Earth ground ports		
IEC 61000-4-8	Magnetic Field	Enclosure ports	40 A/m continuous, 1000 A/m for 1 s	
IEC 61000-4-29	Voltage Dips & Interrupts	DC Power ports	30% for 0.1 s, 60% for 0.1 s, 100% for 0.05 s	
		AC Power ports	30% for 1 period, 60% for 50 periods	
IEC 61000-4-11			100% for 5 periods, 100% for 50 periods[2]	

Test	Description		Test Levels	Severity Levels
IEC 61000-4-12	Damped Oscillatory	Signal ports	2.5 kV common, 1 kV differential mode @ 1 MHz	3
		DC Power ports	2.5kV common,1kV differential mode @ 1 MHz	3
		AC Power ports	2.5 kV common, 1 kV differential mode @ 1 MHz	3
IEC 61000-4-16	Mains Frequency Voltage	Signal ports	30 V Continuous, 300 V for 1 s	4
		DC Power ports	30 V Continuous, 300 V for 1 s	4
IEC 61000-4-17	Ripple on DC Power Supply	DC Power ports	10%	3
IEC 60255-5	Dielectric Strength	Signal ports	2 kVAC (Fail-Safe Relay output)	
		DC Power ports	1.5 kVDC	
		AC Power ports	2 kVAC	
	HV Impulse	Signal ports	5 kV (Fail-Safe Relay output)	
		DC Power ports	5 kV	
		AC Power ports	5 kV	

[a] *Siemens-specified severity levels*

[c] *Only applicable to functional earth connections separated from the safety earth connection.*

IEEE 1613 (C37.90.x) EMI Immunity Type Tests

NOTE
The RX1100 meets Class 2 requirements for an all-fiber configuration and Class 1 requirements for copper ports.

Test	Description		Test Levels
IEEE C37.90.3	ESD	Enclosure Contact	+/- 8 kV
		Enclosure Air	+/- 15 kV
C37.90.2	Radiated RFI	Enclosure ports	35 V/m
IEEE C37.90.1	Fast Transient	Signal ports	+/- 4 kV @ 2.5 kHz
		DC Power ports	+/- 4 kV
		AC Power ports	+/- 4 kV
		Earth ground ports	+/- 4 kV
	Oscillatory	Signal ports	2.5 kV common mode @ 1 MHz

Test	Description		Test Levels
		DC Power ports	2.5 kV common and differential mode @ 1 MHz
		AC Power ports	2.5 kV common and differential mode @ 1 MHz
IEEE C37.90	HV Impulse	Signal ports	5 kV (Failsafe Relay)
		DC Power ports	5 kV
		AC Power ports	5 kV
IEEE C37.90	Dielectric Strength	Signal ports	2 kVAC (Failsafe Relay)
		DC Power ports	2 kVAC
		AC Power ports	2 kVAC

Environmental Type Tests

Test	Description		Test Levels
IEC 60068-2-1	Cold Temperature	Test Ad	-40 °C (40 °F), 16 Hours
IEC 60068-2-2	Dry Heat	Test Bd	85 °C (185 °F), 16 Hours
IEC 60068-2-30	Humidity (Damp Heat, Cyclic)	Test Db	95% (non-condensing), 55 °C (131 °F), 6 cycles
IEC 60255-21-1	Vibration		2 g @ 10-150 Hz
IEC 60255-21-2	Shock		30 g @ 11 ms

Section 6.5

Cellular Modem Certifications

Certification	Standard
Safety	UL 60950-1 cUL 60950-1 EN 60950-1 AS/NZS 6950:2000
EMC	FCC Part 2, 15, 22, 24 EN 55022 EN 55024
Network	PTCRB