SIEMENS

RUGGEDCOM RS910L

Installation Guide

10/2013

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Table of Contents

Preface

This guide describes the RUGGEDCOM RS910L. 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.

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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:

- *ROS User Guide for RS910LW/RS920LW*

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1 Introduction

The RUGGEDCOM RS910L is an industrially hardened serial device server and managed Ethernet switch supporting Ethernet over VDSL (EoVDSL). The RS910L can be configured with two serial ports (RS485/RS422/RS232) and/or two Ethernet ports (copper of fiber). The RS910L can interconnect multiple types of intelligent electronic devices (IEDs) that have different methods of communications. The EoVDSL port allows for aggregation of these devices at a remote location back to the central control room using existing telephone grade cable (or other legacy serial cabling). The EoVDSL uplink allows up to 5 km (3 mi) LAN segments at up to 35 Mbps. It is the perfect solution for bringing Ethernet networking to serial devices and applications where existing wiring is already present thus saving the considerable cost of upgrading existing legacy devices or installing new network cabling.

Designed to operate reliably in harsh industrial environments the RS910L provides a high level of immunity to electromagnetic interference and heavy electrical surges typical of environments found in electric utility substations, factory floors or in curb-side traffic control cabinets. An operating temperature range of -40 to 85 °C (-40 to 185 °F) coupled with hazardous location certification, optional conformal coating and a galvanized steel enclosure allows the RS910L to be placed in almost any location.

The RS910L is packaged in a compact, galvanized steel enclosure that allows either DIN or panel mounting for efficient use of cabinet space. The RS910L provides an integrated power supply with a wide range of voltages (88-300 VDC or 85-264 VAC) for worldwide operability or dual-redundant, reversible polarity, 12 VDC, 24 VDC and 48 VDC power supply inputs for high availability applications requiring dual or backup power inputs.

The RS910L's superior ruggedized design coupled with the embedded Rugged Operating System (ROS) provides improved system reliability and advanced networking features making it ideally suited for creating Ethernet networks for mission-critical, real-time, control applications.

The following sections provide more information about the RS910L:

- Section 1.1, “Feature Highlights”
- Section 1.2, “Ports, Controls and Indicator LEDs”

Section 1.1

Feature Highlights

Interface Ports

- One Ethernet over VDSL (EoVDSL) interface
- Two Serial and/or two Fast Ethernet Ports
- RS485/RS422/RS232 Serial Ports (DB9 or RJ45)
- Serial Fiber Interface (ST) available
- 10/100Base-TX or 100Base-FX Ethernet ports

Cyber Security

- Multi-level user passwords
- SSH/SSL (128-bit encryption)
- Enable/disable ports, MAC based port security

- Port based network access control (802.1x)
- VLAN (802.1Q) to segregate and secure network traffic
- RADIUS centralized password management
- SNMPv3 authentication and 56-bit encryption

Ethernet Over VDSL (EoVDSL)

- Up to 5 km (3 mi) LAN segments
- Symmetric data rates up to 35 Mbps
- Asymmetric data rates up to 40 Mbps
- Automatically selects fastest data rate based on distance and quality of cable
- Software selectable to be master or slave
- Frequency Division Multiplexing (FDM)

Rated for Reliability in Harsh Environments

- Immunity to EMI and heavy electrical surges
  - Meets IEEE 1613 class 1 (electric utility substations)
  - Exceeds IEC 61850-3 (electric utility substations)
  - Exceeds IEC 61800-3 (variable speed drive systems)
  - Exceeds IEC 61000-6-2 (generic industrial)
  - Exceeds NEMA TS-2 (traffic control equipment)
- Hazardous Location Certification: Class 1 Division 2
- -40 to 85 °C (-40 to 185 °F) operating temperature (no fans)
- 20 AWG galvanized steel enclosure
- DIN or panel mounting options provide secure mechanical reliability
- Conformal coated printed circuit boards (optional)

Management Tools

- Web-based, Telnet, CLI management interfaces
- SNMP v1/v2/v3 (56-bit encryption)
- Remote Monitoring (RMON)
- Rich set of diagnostics with logging and alarms

Universal Power Supply Options

- Fully integrated power supply
- Universal high-voltage range: 88-300 VDC or 85-264 VAC
- Dual low-voltage DC inputs: 24 VDC (10-36 VDC) or 48 VDC (36-72 VDC)
- Terminal blocks for reliable maintenance free connections
- CSA/UL 60950-1 safety approved to 85 °C (185 °F)

Section 1.2

Ports, Controls and Indicator LEDs

The RS910L features various ports, controls and indicator LEDs on the front panel for configuring and troubleshooting the device.

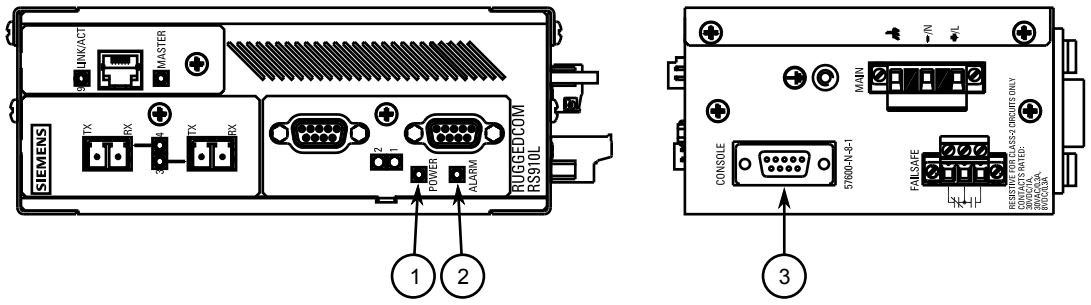

Figure 1: Front Panel

1. Power Indicator LEDs **2.** Alarm Indicator LED **3.** RS232 Serial Console Port

Power Indicator LEDs	The power indicator LED illuminates when power is being supplied to the device.
Alarm Indicator LED	The alarm indicator LED illuminates when an alarm condition exists.
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 AG 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 RS910L is designed for maximum mounting and display flexibility. It can be equipped with connectors that allow it to be installed in a 35 mm (1.4 in) DIN rail or directly on a panel.

NOTE
For detailed dimensions of the device with either 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 on a DIN Rail

For DIN rail installations, the RS910L can be equipped with a DIN rail bracket pre-installed on the back of the chassis. The bracket allows 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 slot in the bracket with the DIN rail.

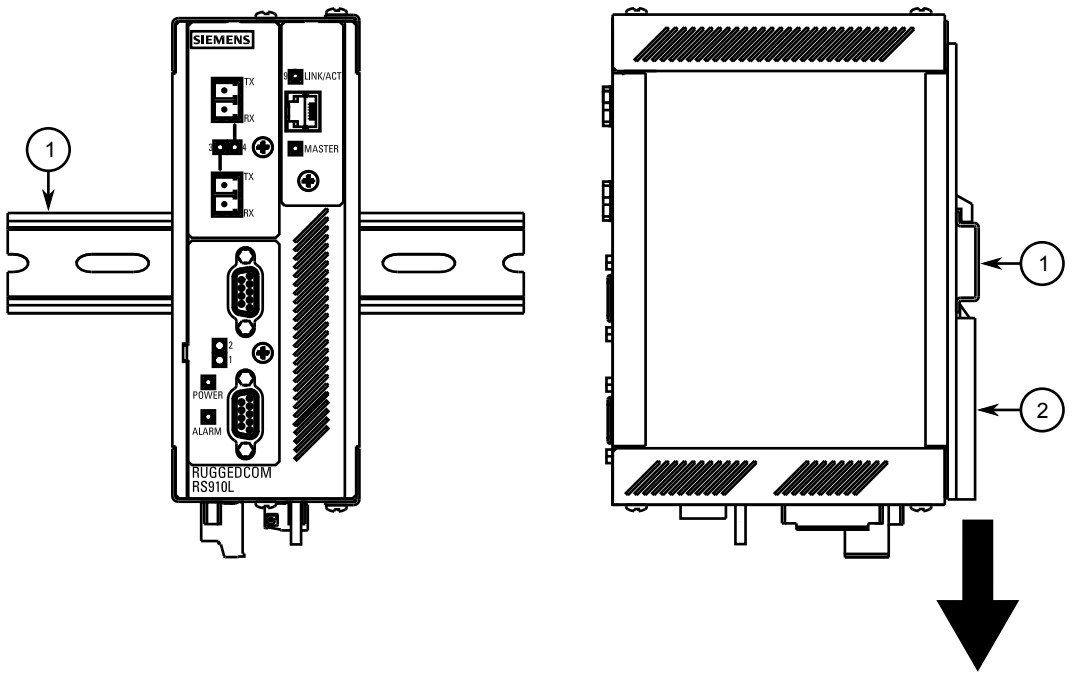

Figure 2: DIN Rail Mounting

1. DIN Rail **2.** DIN Rail Bracket

2. Pull the release on the bracket down and slide the device onto the DIN rail. Let go of the release to lock the device in position.

Section 2.1.2

Mounting the Device to a Panel

For panel installations, the RS910L can be equipped with panel adapters pre-installed on the top and bottom 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.

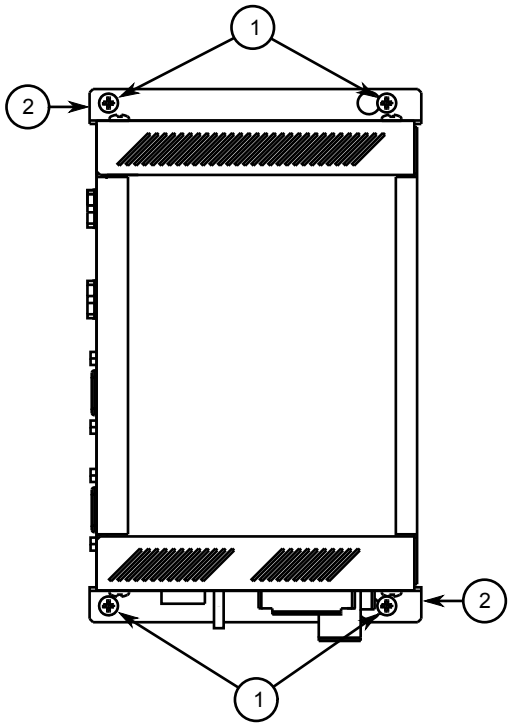

Figure 3: Panel Mounting

1. Screw **2.** Panel Adaptor

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

Section 2.2

Connecting Power

The RS910L supports a single integrated high AC/DC or low DC power supply

NOTE

- *For 110/230 VAC rated equipment, an appropriately rated AC circuit breaker must be installed.*
- *For 125/250 VDC rated equipment, an appropriately rated DC circuit breaker must be installed.*
- *Equipment must be installed according to applicable local wiring codes and standards.*
- *All line-to-ground transient energy is shunted to the Surge Ground terminal. In cases where users require the inputs to be isolated from ground, remove the ground braid between Surge and Chassis Ground. Note that all line-to-ground transient protection circuitry will be disabled.*

IMPORTANT!

Siemens requires the use of external surge protection in VDSL applications where the line may be subject to surges greater than that for which the device is rated. Use the following specifications as a guide for VDSL external surge protection:

- *Clamping Voltage: 50 V to 200 V*

- *Insertion Loss: < 0.1 dB at 10 MHz*
- *Peak Surge Current: 10 kA, 8x20µs waveform*

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

- Section 2.2.1, “Connecting High AC/DC Power”
- Section 2.2.2, “Connecting Low DC Power”

Section 2.2.1

Connecting High AC/DC Power

To connect a high AC/DC 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 braided ground cable connected to the surge ground terminal and chassis ground. This cable connects transient suppression circuitry to chassis ground and must be removed in order to avoid damage to transient suppression circuitry during testing.

1. Connect the positive wire from the power source to the positive/live (+/L) terminal on the terminal block.

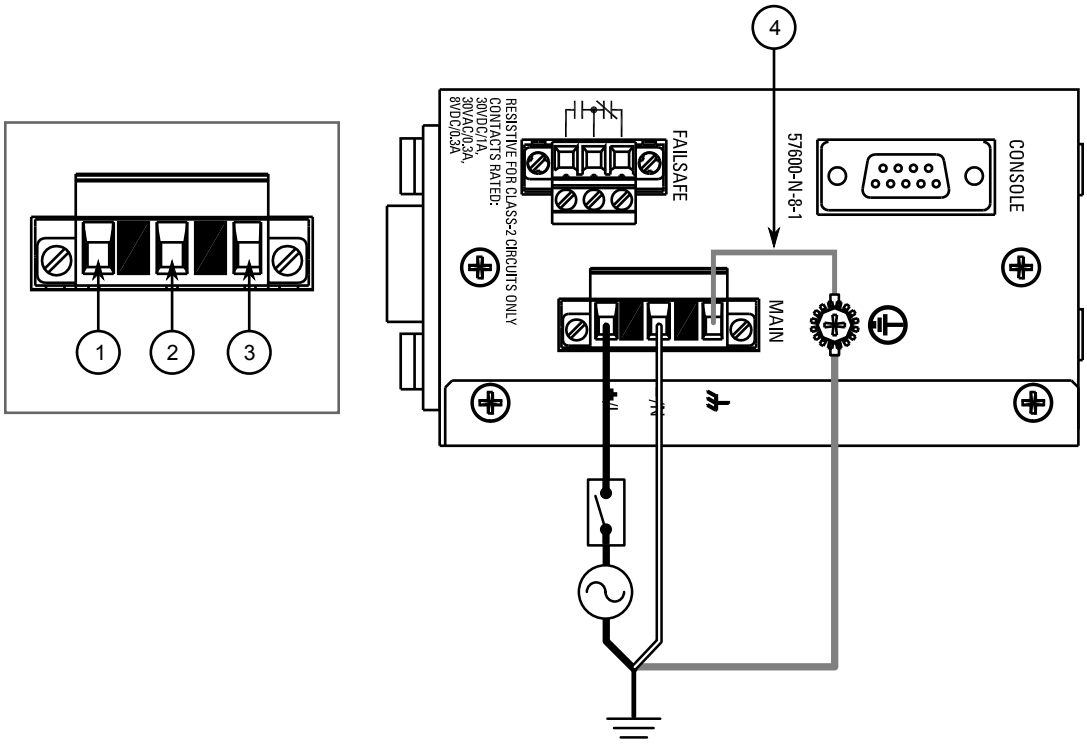

Figure 4: Terminal Block Wiring

1. Positive/Live (+/L) Terminal **2.** Negative/Neutral (-/N) Terminal **3.** Surge Ground Terminal **4.** Braided Ground Cable

2. Connect the negative wire from the power source to the negative/neutral (-/N) terminal on the terminal block.
3. Using a braided wire or other appropriate grounding wire, connect the surge ground terminal to the chassis ground connection. The surge ground terminal is used as the ground conductor for all surge and transient suppression circuitry internal to the unit.
4. Connect the ground terminal on the power source to the chassis ground terminal on the device.

Section 2.2.2

Connecting Low DC Power

To connect a 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 braided ground cable connected to the surge ground terminal and chassis ground. This cable connects transient suppression circuitry to chassis ground and must be removed in order to avoid damage to transient suppression circuitry during testing.

1. Connect the positive wire from the power source to the positive terminal on the terminal block.

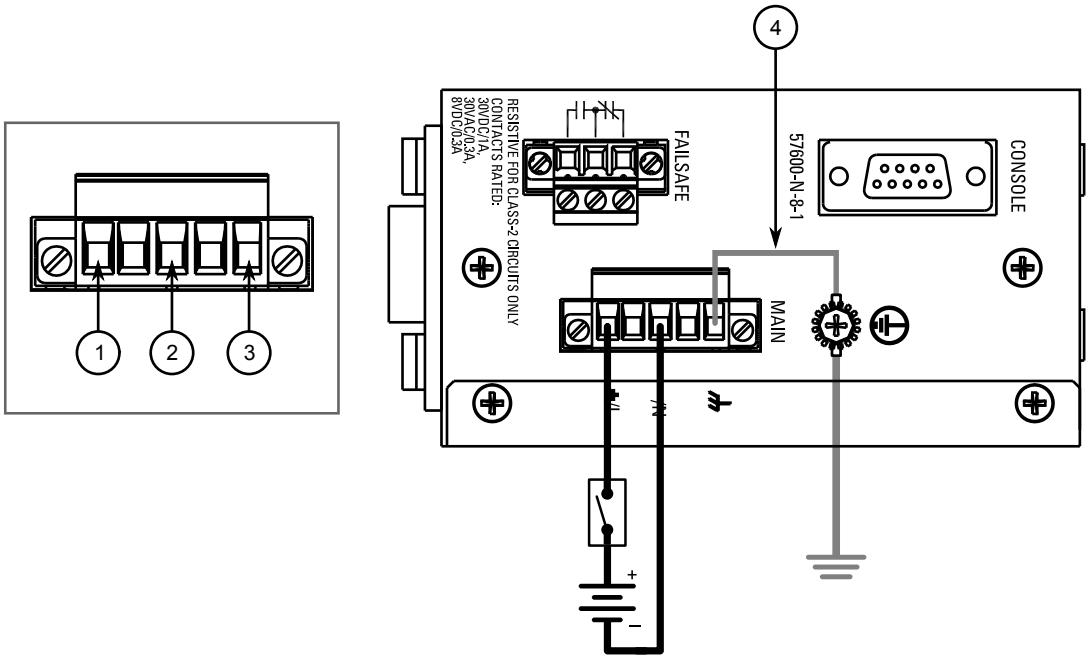

Figure 5: Terminal Block Wiring

1. Positive Terminal **2.** Negative Terminal **3.** Surge Ground Terminal **4.** Braided Ground Cable

2. Connect the negative wire from the power source to the negative terminal on the terminal block.
3. Using a braided wire or other appropriate grounding wire, connect the surge ground terminal to the chassis ground connection. The surge ground terminal is used as the ground conductor for all surge and transient suppression circuitry internal to the unit.
4. Connect the ground terminal on the power source to the chassis ground terminal on the device.

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 ROS . One common application for this relay is to signal an alarm if a power failure occurs. For more information, refer to the ROS User Guide for the RS910L.

The following shows the proper relay connections.

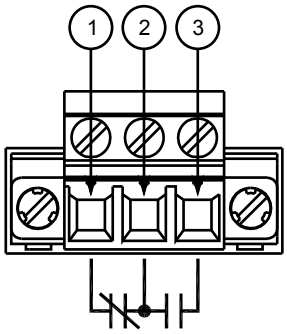

Figure 6: Failsafe Alarm Relay Wiring

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

Section 2.4

Connecting to the Device

The following describes the various methods for accessing the ROS console and Web interfaces on the device. For more detailed instructions, refer to the *ROS User Guide* for the RS910L.

Serial Console Port

Connect a PC or terminal directly to the serial console port to access the boot-time control and ROS console interface.

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

The serial console port implements RS232 DCE (Data Communication Equipment) on a DB9 connector. The following is the pin-out for the port:

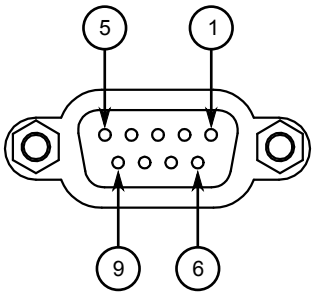

Figure 7: Serial DB9 Console Port

Pin	Name	Description
1	DCD	Data Carrier Detect
2	RX	Receive Data
3	TX	Transmit Data
4	DTR	Data Terminal Ready
5	GND	Signal Ground
6	DSR	Data Set Ready
7	RTS	Request to Send
8	CTS	Clear To Send
9	Reserved (Do Not Connect)	

Communication Ports

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

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.

3 Communication Ports

The RS910L 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 ROS . For more information on how to access the factory data file, refer to the *ROS User Guide* for the RS910L.

Each communication port type has a specific place in the RS910L chassis.

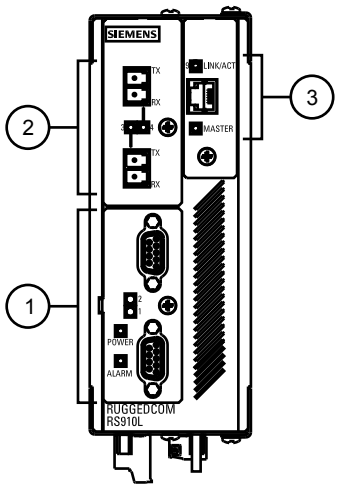

Figure 8: Port Assignment

1. Ports 1 to 2 **2.** Ports 3 to 4 **3.** Port 9

Port	Type
1 to 2	Serial Ports
3 to 4	Fast Ethernet Ports (10/100Base-TX or 10/100Base-FX)
9	EoVDSL Port

The following sections describe the available ports:

- Section 3.1, “Copper Ethernet Ports”
- Section 3.2, “Fiber Optic Ethernet Ports”
- Section 3.3, “EoVDSL Ports”
- Section 3.4, “Serial Ports”
- Section 3.5, “Connecting Multiple RS485 Devices”

Section 3.1
Copper Ethernet Ports

The RS910L 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 receptacles are directly connected to the chassis ground on the device and can accept CAT-5 shielded twisted-pair (STP) cables.

WARNING!
Electric shock hazard – risk of serious personal injury and/or equipment interference. If shielded cables are used, make sure the shielded cables do not form a ground loop via the shield wire and the RJ45 receptacles at either end. Ground loops can cause excessive noise and interference, but more importantly, create a potential shock hazard that can result in serious injury.

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 connectors:

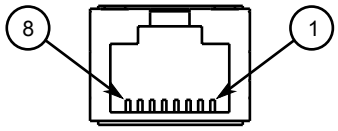

Figure 9: RJ45 Ethernet Port Pin Configuration

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.

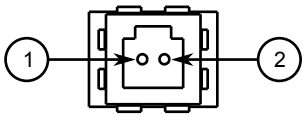

Figure 10: MTRJ Port

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

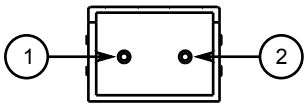

Figure 11: LC Port

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

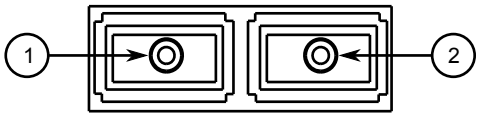

Figure 12: SC Port

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

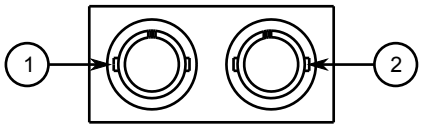

Figure 13: ST Port

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

For specifications on the available fiber optic Ethernet ports, refer to Section 4.5, “Fiber Optic Ethernet Port Specifications”.

Section 3.3

EoVDSL Ports

Ethernet over VDSL (EoVDSL) ports operate in pairs with one device configured as the Master and the other as the Slave. In VDSL (Very-high-bit-rate Digital Subscriber Line), the terms Central Office (CO) or Line Termination (LT) are used interchangeably for the Master and the terms Customer Premise Equipment (CPE) or Network Termination (NT) are used interchangeably for the Slave. The Master device dictates the line configuration settings to the Slave so all EoVDSL configuration is done on the Master. Data flowing from the Master to the Slave is designated *downstream* while data flowing from the Slave to the Master is designated *upstream*.

Siemens offers two flavors of VDSL: Universal EoVDSL and Long-Reach EoVDSL. Universal EoVDSL ports are Master/Slave selectable and offer symmetric data rates up to 35 Mbps with distances up to 2.5 km (1.6 mi). Long-Reach EoVDSL ports are fixed as either Master or Slave but offer asymmetric data rates up to 40 Mbps with distances up to 5 km (3.1 mi).

The Universal and Long-Reach EoVDSL ports are physically indistinguishable from each other. However, the port type can be determined either from the order code or through ROS.

EoVDSL ports can be connected using RJ11 male connectors. Each EoVDSL port has a **Link/Act** LED and a **Master** LED. On devices with Universal EoVDSL ports, the **Master** LED can be toggled on or off depending on whether the port is set to be a Master or Slave. On devices with Long-Reach EoVDSL ports, the **Master** LED will be on all the time if the device is set to be the Master, or off if the device is set to be the Slave.

Status LED	State	Description
Master	Green (Solid)	The device is in Master mode.
	Off	The device is in Slave mode.
Link/Act	Green (Solid)	Link established
	Green (Blinking)	Link activity

Status LED	State	Description
	Off	No link detected

NOTE
All RJ11 connectors conform to the standard telephony pin configuration.

The following is the pin-out for the RJ11 connectors:

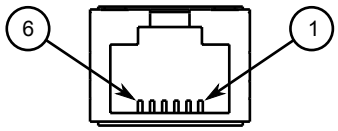

Figure 14: EoVDSL RJ11 Modem Port

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)

The following sections describe the EoVDSL ports in more detail:

- Section 3.3.1, “EoVDSL Wiring”
- Section 3.3.2, “Configuration and Setup”
- Section 3.3.3, “EoVDSL Performance”

Section 3.3.1
EoVDSL Wiring

VDSL operates over 2-wire Category 3 (CAT-3) or higher twisted-pair wiring. Other twisted-pair wiring with similar characteristics may work, although the performance will vary depending on the cable characteristics and distance.

When wiring EoVDSL ports, note the following:

- Twisted-pairs are an effective way of reducing both magnetic and capacitive interference because they reduce the magnetic loop area to nearly zero and maintain a consistent distribution of capacitances to both ground and other sources. Therefore, make sure twisting is consistent throughout cable length.
- Open leads (also known as bridged taps or drop-lines) along the length of the cable will cause an impedance mismatch and result in VDSL signal degradation.
- Make sure the cable impedance is consistent throughout the run. Avoid mixing different wiring (e.g. wiring with different gages) in cable runs, as this will cause an impedance mismatch and result in VDSL signal degradation.
- Make sure wiring is adequately separated between power and control circuits. Switching spikes and surges in power and control circuits can couple noise onto the VDSL line, causing interruptions in communications.
- Lower speeds are less susceptible to interference and will transmit greater distances over the same wiring than higher speeds. Use the minimum speed that will provide adequate data transfer speed.

Section 3.3.2
Configuration and Setup

If the RS910L and another device both have Universal EoVDSL ports, configure one device to be the Master and the other the Slave. If both devices have a Long-Reach EoVDSL port, no Master/Slave configuration is necessary, since the ports will already be fixed as Master or Slave. Once configured and connected together, each device will attempt to achieve the maximum speed based on the line length and conditions. The device's link LED may flash on and off several times before setting on a final link speed and declaring the port up. For more information about configuring the RS910L, refer to the *ROS User Guide for RS910LW/RS920LW*.

Section 3.3.3
EoVDSL Performance

The EoVDSL ports can be configured to operate in one of two modes: Auto Mode (default) and Manual Mode. In Auto Mode, the device will step through the different speeds and automatically select the best bit-rate based on the current line conditions. In Manual Mode, the user can select one of the speed settings and the device will only attempt to attain the set speed. If the line conditions degrade (reducing the SNR or Signal to Noise Ratio), but the device is able to maintain the link, an alarm will be triggered to notify the user of the reduced SNR. By configuring the **`Rescan Mode`** parameter in ROS, the user can control at which point the scan process will be restarted when the line conditions degrade. If `Link only` is selected, the device will restart the scan process if the line conditions degrade such that the device is unable to maintain the current link. If `Link or SNR` is selected, the device will restart the scan process if either the SNR has dropped below a pre-defined acceptable level or when the device is unable to maintain the current link, or whichever comes first. Note that if **`Mode`** is set to `Manual Mode`, the restart of the scan process will only attempt to attain the set speed in Manual Mode.

For information about configuring EoVDSL, refer to the *RUGGEDCOM ROS for the RS910L*.

NOTE

- *EoVDSL ports are designed to be used on private communications lines for point-to-point connections and are not to be connected to the Public Switched Telephone Network (PSTN).*
- *To reduce the risk of fire, use only No. 26 AWG or larger telecommunication line cord.*
- *In Manual Mode, assuming the distance can support the speed setting, the time to port up is typically 15-30 seconds.*

On 24 American Wire Gage (AWG) Polyethylene Insulated Cable (PIC) twisted-pair wiring, the following performance is typical with Universal EoVDSL ports:

Distance (km)	Distance (feet)	Downstream / Upstream (Mbps)	Time to Achieve Port Up in Auto Mode (Seconds)
0.50	1600	35	15
0.60	2000	30	30
0.70	2300	25	45
0.90	3000	20	60
1.00	3300	15	75
1.30	4300	10	90
1.70	5600	5	105
2.00	6600	2.5	120

Distance (km)	Distance (feet)	Downstream / Upstream (Mbps)	Time to Achieve Port Up in Auto Mode (Seconds)
2.50	8200	1.2	150

The following performance is typical with Long-Reach EoVDSL ports:

Distance (km)	Distance (feet)	Downstream (Master to Slave) (Mbps)	Upstream (Slave to Master) (Mbps)	Time to Achieve Port Up in Auto Mode (Seconds)
0.50	1600	40	20	15
1.00	3300	25	5	30
1.50	4900	20	0.54	45
2.00	6600	15	0.54	60
2.50	8200	10	0.54	75
3.20	10500	5	0.54	90
4.00	13100	2.1	0.54	105
4.60	15100	1.2	0.54	120
5.00	16400	0.48	0.18	150

Section 3.4

Serial Ports

The RS910L supports DB9, RJ45 and SC (Standard or Subscriber Connector) fiber serial ports, all of which can be run in RS232, RS485 or RS422 mode.

NOTE
On power-up, all serial ports default to RS485 mode. Each port can be individually set to RS232, RS485 or RS422 mode through ROS . For more information, refer to the ROS User Guide for the RS910L.

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 4.6, “Serial Port Specifications”.

For information about how to connect devices configured to run in RS485 mode, refer to Section 3.5, “Connecting Multiple RS485 Devices”.

The following are the pin-outs for the DB9, RJ45 and SC connectors:

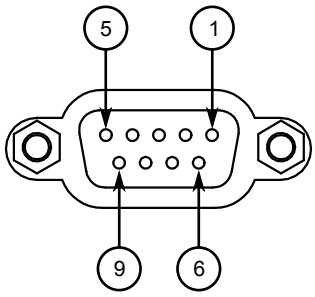

Figure 15: Serial DB9 Port

Pin[a]	RS232 Mode	RS485 Mode	RS422 Mode
1	DCD		
2	TX	TX/RX+	TX+
3	RX		RX+
4	DTR		
5	Common (Isolated Ground)[b]		
6	DSR		RX-
7	CTS[cd]	TX/RX-	TX-
8	RTS[cd]		
9	RI (No Connection)		
Shield	Chassis Ground		

[a] *No internal termination is provided.*

[b] *The Common terminal is optically isolated. However, there is transient voltage protection circuitry between the Common terminal and chassis ground.*

[c] *Connected internally.*

[d] *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.*

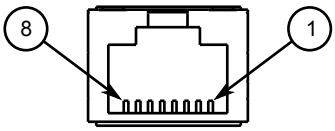

Figure 16: Serial RJ45 Port

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

[e] *No internal termination is provided.*

[f] *Connected internally.*

[g] *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.*

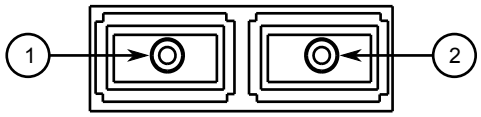

Figure 17: Serial SC Fiber Port

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

Section 3.5

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.

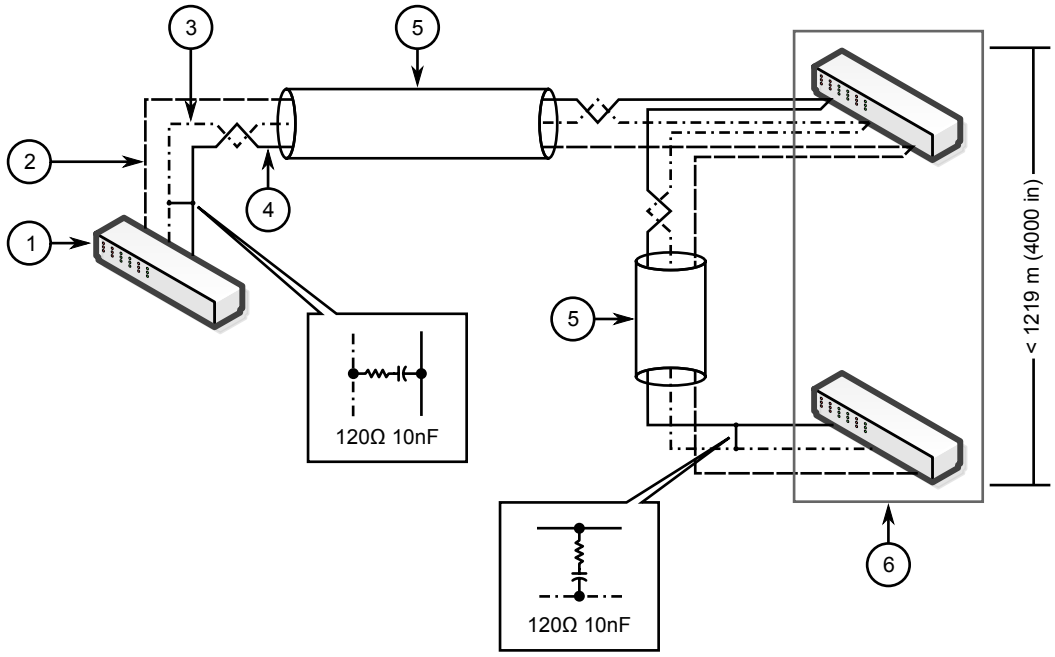

Figure 18: Recommended RS485 Wiring

1. RS910L 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			
HI	88 VDC	300 VDC	3.15 A(T)	4 kVAC	10 W
	87 VAC	264 VAC		5.5 kVDC	
24	10 VDC	36 VDC		1.5 kVDC	
48	36 VDC	72 VDC		1.5 kVDC	

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

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

[c] *Power consumption varies based on configuration.*

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
Isolation	1500 V_{rms}[d]

[d] *Dielectric test voltage (1 minute) between coil and contacts*

Section 4.3
Copper Ethernet Port Specifications

The following details the specifications for copper Ethernet ports that can be ordered with the RS910L.

Order Code	Speed[e]	Connector	Duplex[e]	Cable Type[f]	Wiring Standard[g]	Maximum Distance[h]	Isolation[i]
TX01	10/100TX	RJ45	FDX/HDX	> Category 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
10Base-FL Fiber Optic Ethernet Port Specifications

Order Code	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)
FL01	MM	ST	62.5/125	850	-16	-9	-34	-11.2	2	18
			50/125		-19.8	-12.8				14.2

Section 4.5
Fiber Optic Ethernet Port Specifications

The following details the specifications for fiber Ethernet ports that can be ordered with the RS910L.

NOTE
Order codes are contained within each product when assembled and configured at the factory. Refer to the ROS User Guide for the RS910L 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.*

Order Code	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)
FX01	MM	ST	62.5/125	1300	-19	-14	-31	-14	2	12
			50/125		-22.5					8.5
FX02	MM	SC	62.5/125	1300	-19	-14	-31	-14	2	12
			50/125		-22.5					8.5
FX03	MM	MTRJ	62.5/125	1300	-19	-14	-31	-14	2	12
FX04	SM	ST	9/125	1300	-15	-8	-32	-3	20	17
FX05	SM	SC	9/125	1300	-15	-8	-31	-7	20	16
FX06	SM	LC	9/125	1300	-15	-8	-34	-7	20	19
FX07	SM	SC	9/125	1300	-5	0	-34	-3	50	29
FX08	SM	LC	9/125	1300	-5	0	-35	3	50	30
FX09	SM	SC	9/125	1300	0	5	-37	0	90	37
FX10	SM	LC	9/125	1300	0	5	-37	0	90	37
FX11	MM	LC	50/125	1300	-22.5	-14	-31	-14	2	8.5

Section 4.6

Serial Port Specifications

The following sections detail specifications for ports that can be equipped on the RS910L . The user determines the type of optics at the time of ordering, and can determine the ports installed on a particular unit by reading the factory data file via the ROS user interface. The specifications are organized by order code. Module order codes are contained within each unit when it is assembled and configured at the factory. For information about obtaining factory configuration data, refer to the *ROS User Guide* for the RS910L.

- Section 4.6.1, “Copper Serial Port Specifications”
- Section 4.6.2, “Fiber Serial Port Specifications”

Section 4.6.1

Copper Serial Port Specifications

Order Code	Baud Rate	Connector	Isolation
S1	300 to 230 kbps	DB9 or RJ45	2.5 kV
S2			

Section 4.6.2
Fiber Serial Port Specifications

Order Code	Mode	Connector	Typical Distance (km)	Optical Wavelength (nm)	Cable Size
S3	Multimode	ST	5	850	50/125
					62.5/125

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	1.2 kg (2.7 lbs)
Ingress Protection	IP40 (1 mm or 0.04 in objects)
Enclosure	20 AWG Galvanized Steel

5 Dimension Drawings

NOTE
All dimensions are in millimeters, unless otherwise stated.

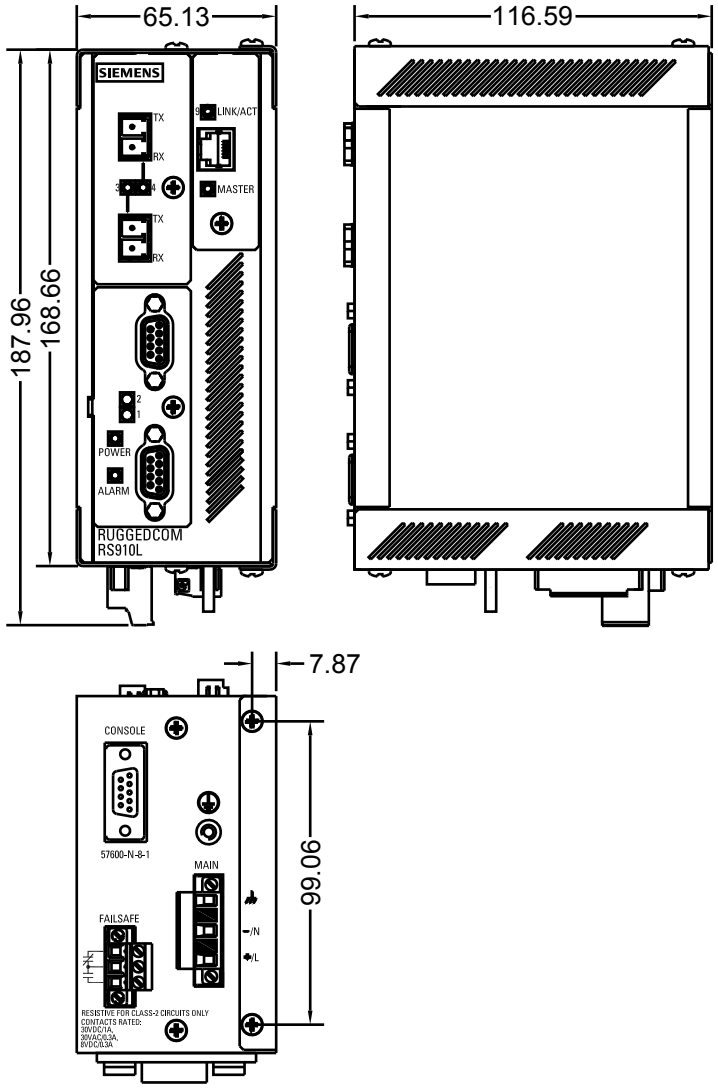

Figure 19: Overall Dimensions

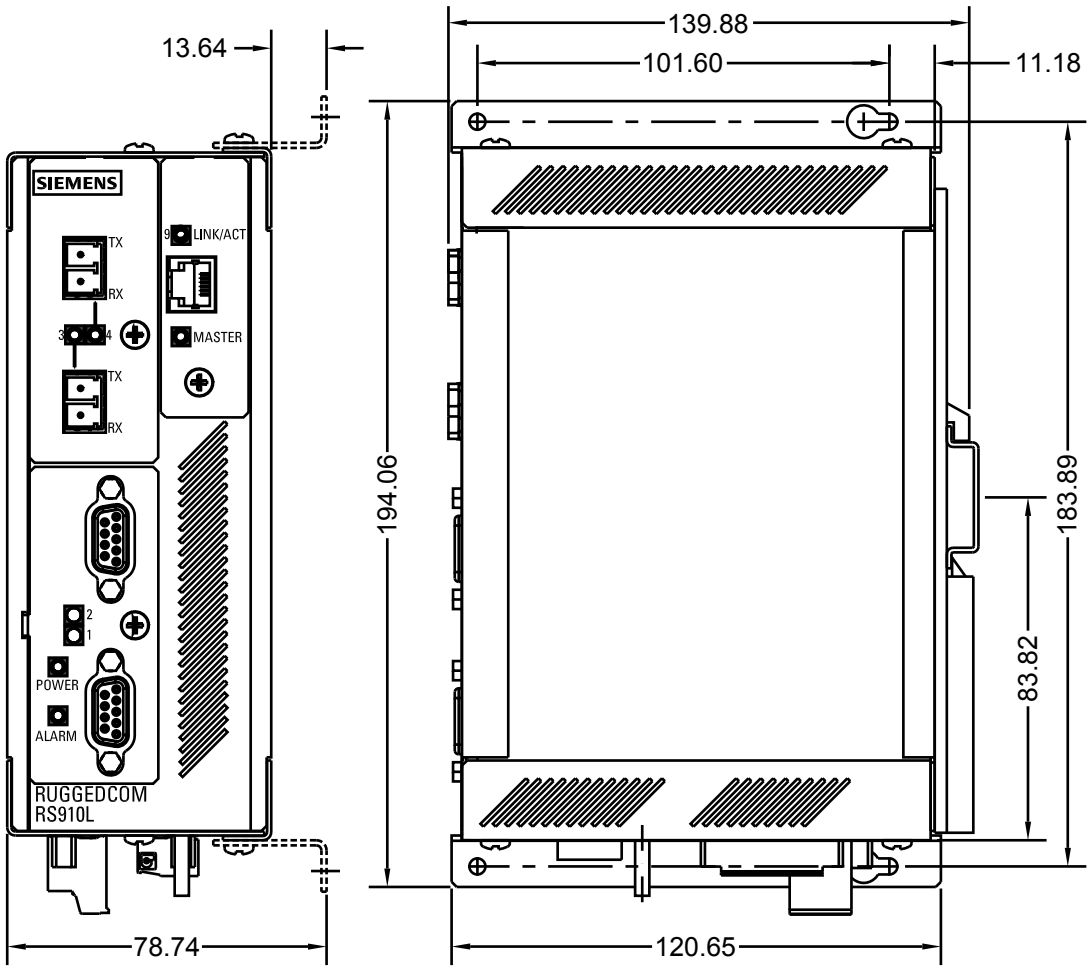

Figure 20: Panel and DIN Rail Mount Dimensions

6 Certification

The RS910L 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, EN60825-1, EN55022 Class A, 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 RS910L has passed the following EMI and environmental tests.

IEC 61850-3 Type Tests

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	x
IEC 61000-4-4	Burst (Fast Transient)	Signal ports	+/- 4 kV @ 2.5 kHz	x
		DC Power ports	+/- 4 kV	4
		AC Power ports	+/- 4 kV	4
		Earth ground ports	+/- 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
		DC Power ports	10 V	3
		AC Power ports	10 V	3
		Earth ground ports	10 V	3
IEC 61000-4-8	Magnetic Field	Enclosure ports	40 A/m continuous, 1000 A/m for 1 s	
IEC 61000-4-29	Voltage Dips and 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	
IEC 61000-4-12	Damped Oscillatory	Signal ports	2.5 kV common, 1 kV differential mode @ 1 MHz	3
		DC Power ports	2.5 kV common, 1 kV 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

Test	Description		Test Levels	Severity Levels
IEC 60255-5	Dielectric Strength	Signal ports	2 kVAC (Fail-Safe Relay output)	
		DC Power ports	1.5 kVDC	
		AC Power ports	2 kVDC	
	HV Impulse	Signal ports	5 kV (Fail-Safe Relay Output)	
		DC Power ports	5 kV	
		AC Power ports	5 kV	

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

NOTE
The RS910L meets Class 2 requirements for an all-fiber configuration and Class 1 requirements for copper ports.

IEEE Test	IEEE 1613 Clause	Description		Test Levels
C37.90.3	9	ESD	Enclosure Contact	+/- 8 kV
			Enclosure Air	+/- 15 kV
C37.90.2	8	Radiated RFI	Enclosure ports	35 V/m
C37.90.1	7	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 @ 1MHz
			DC Power ports	2.5 kV common and differential mode @ 1MHz
			AC Power ports	2.5 kV common and differential mode @ 1MHz
C37.90	6	HV Impulse	Signal ports	5 kV (Failsafe Relay)
			DC Power ports	5 kV
			AC Power ports	5 kV
		Dielectric Strength	Signal ports	2 kVAC (Failsafe Relay)
			DC Power ports	1.5 kVDC
			AC Power ports	2 kVAC

Environmental Type Tests

Test	Description		Test Levels	Severity 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	

Test	Description		Test Levels	Severity Levels
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	Class 2
IEC 60255-21-2	Shock		30 g @ 11 ms	Class 2