

SIEMENS

RUGGEDCOM RS401

Installation Guide

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Preface

This guide describes the RUGGEDCOM RS401. 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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- [“ Alerts ”](#)
- [“Related Documents”](#)
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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:

- ROS User Guide for the RS401

Accessing Documentation

The latest user documentation for RUGGEDCOM RS401 v is available online at www.siemens.com/ruggedcom. To request or inquire about a user document, contact Siemens Customer Support.

Training

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

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

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

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

1 Introduction

The RUGGEDCOM RS401 is an industrially hardened, serial device server with an integrated, fully managed Ethernet switch, designed to operate reliably in electrically harsh and climatically demanding environments. Featuring an integrated 4 port serial server, a 4 port managed Ethernet switch, and an optional V.90 modem, the RS401 is able to interconnect multiple types of intelligent electronic devices (IEDs) that have different methods of communications. Using the RS401 results in fewer connectivity devices (which reduces overall system costs) and also extends the useful life of existing legacy IEDs (which minimizes capital expenditure for new equipment).

The RS401's compact design makes it ideally suited for panel mount locations or installations with tight space restrictions.

The RS401 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. The RS401 meets or exceeds a wide range of industry standards including IEC61850, IEEE1613, IEC61000-6-2, IEC1800-3 and NEMA TS-2. The RS401 also features a wide operating temperature range of -40 to 85 °C (-40 to 185 °F) allowing it to be installed in virtually any location.

The RS401 also includes an industrially rated integrated power supply that can support a wide range of power supply options suitable for multiple industries and for worldwide operability. Options include 24 VDC, 48 VDC, 88-300 VDC and 85-264VAC, allowing for great installation flexibility.

The embedded Rugged Operating System (ROS) within the RS401 provides advanced Layer 2 and Layer 3 networking functions, advanced cyber security features, and a full array of intelligent functionality for high network availability and manageability. Coupled with the ruggedized hardware design, the RS401 is ideal for creating mission-critical, real-time, control applications in any harsh environment.

CONTENTS

- [Section 1.1, "Feature Highlights"](#)
- [Section 1.2, "Description"](#)

Section 1.1

Feature Highlights

Serial Device Server

- Fully compliant EIA/TIA RS485, RS422, RS232 serial ports (software selectable) - DB9, RJ45, Phoenix style connectors
- Transmit serial data over an IP network
- Support for Modbus TCP, DNP 3, TIN serial protocols
- Baud rates up to 230 kbps
- Point-to-point and multi-point modes
- Convert Modbus RTU to Modbus TCP
- Supports multiple Modbus masters
- Serial IP port redirection software to support PC applications statistics and built-in *sniffer* for troubleshooting

Cyber Security Features

- 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 Ports

- Integrated Ethernet Switch – up to 4 ports
- High performance and throughput Ethernet switching
- Fully IEEE 802.3, IEEE 802.3u, IEEE 802.3x compliance
- Non-blocking, store and forward switching
- 10/100Base-TX, 10Base-FL, 100Base-FX options

Remote Dial Up Access

- Integrated V.90 modem and PPP server
- Provides remote access to serial devices and Ethernet LAN

Rated for Reliability in Harsh Environments

- Immunity to EMI and heavy electrical surges
- Fully independent 2 kV (RMS) isolated serial ports
- -40 to 85 °C (-40 to 185 °F) operating temperature (no fans)
- 18 AWG galvanized steel enclosure

Universal Power Supply Options

- Fully integrated power supplies (no external adapters)
- Popular low voltage ranges: 24 VDC (10-36 VDC), 48 VDC (36-59 VDC)
- Universal high-voltage range: 88-300 VDC or 85-264 VAC
- CSA/UL 60950 safety approved to 85 °C (185 °F)

Section 1.2

Description

The RS401 features various ports, controls and indicator LEDs on the front panel for connecting, configuring and troubleshooting the device.

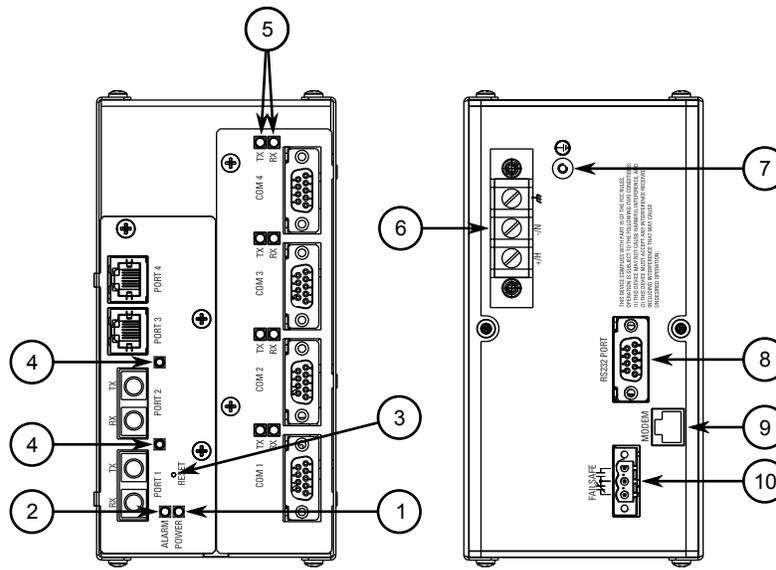


Figure 1: RUGGEDCOM RS401 Modules

1. POWER LED 2. ALARM LED 3. RESET Button 4. Ethernet Port Status LEDs 5. Serial Port Status LEDs 6. Power Supply Terminal Block 7. Surge Ground Terminal 8. RS232 Serial Console Port (DB9) 9. Modem Port (Optional) 10. Failsafe Alarm Relay

POWER LED Illuminates when power is being supplied to the device.

ALARM LED Illuminates when an alarm condition exists.

RESET Button Shuts down and restarts the device.

Ethernet Port Status LEDs Indicate the status of the associated Ethernet port.

LED	State	Meaning
LINK	Solid	Link established
	Blinking	Link activity
	Off	No link detected
Rx	Blinking	Link activity (receive)
	Off	No link activity
Tx	Blinking	Link activity (transmit)
	Off	No link activity

Ethernet Port Status LEDs Indicate the status of the associated serial port.

LED	State	Meaning
RxX	Blinking	Link activity (receive)
	Off	No link activity
Tx	Blinking	Link activity (transmit)
	Off	No link activity

Communication Ports	Receive and transmit data, as well as provide access to the RUGGEDCOM ROS Web interface. For more information about the various ports available for the RUGGEDCOM RS401, refer to Chapter 3, <i>Communication Ports</i> .
RS-232 Console Port	The serial console port is for interfacing directly with the device and accessing initial management functions. For information about connecting to the device via the serial console port, refer to Section 2.6, "Connecting to the Device" .
Failsafe Alarm Relay	Latches to default state when a power disruption or other alarm condition occurs. For more information, refer to: <ul style="list-style-type: none">• Section 2.3, "Connecting the Failsafe Alarm Relay"• Section 4.2, "Failsafe Alarm Relay Specifications"
Power Supply Terminal Block	A pluggable terminal block. For more information, refer to Section 2.2, "Connecting Power" and Section 4.1, "Power Supply Specifications"

2 Installing the Device

This section describes how to install and connect to the RUGGEDCOM RS401.



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.*

CONTENTS

- [Section 2.1, "Mounting the Device"](#)
- [Section 2.2, "Connecting Power"](#)
- [Section 2.3, "Connecting the Failsafe Alarm Relay"](#)
- [Section 2.4, "Grounding the Device"](#)
- [Section 2.5, "Cabling Recommendations"](#)
- [Section 2.6, "Connecting to the Device"](#)

Section 2.1

Mounting the Device

The RS401 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](#).

CONTENTS

- [Section 2.1.1, "Mounting the Device on a DIN Rail"](#)
- [Section 2.1.2, "Mounting the Device to a Panel"](#)

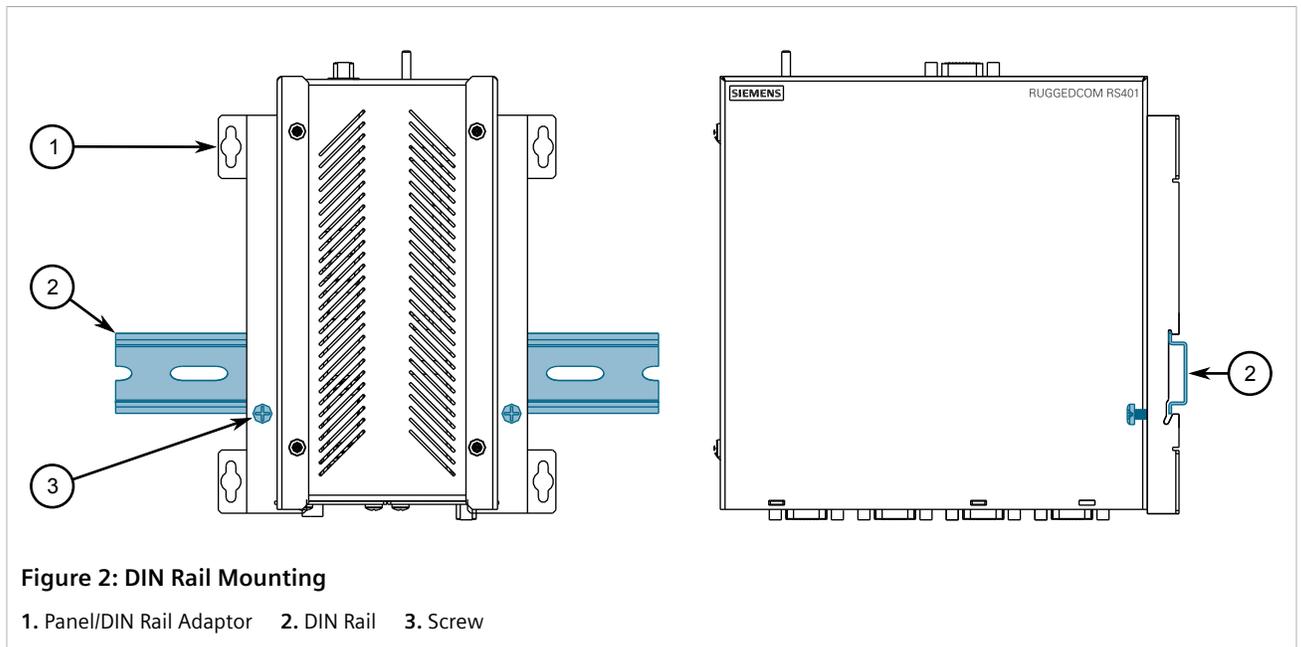
Section 2.1.1

Mounting the Device on a DIN Rail

For DIN rail installations, the RS401 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.



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

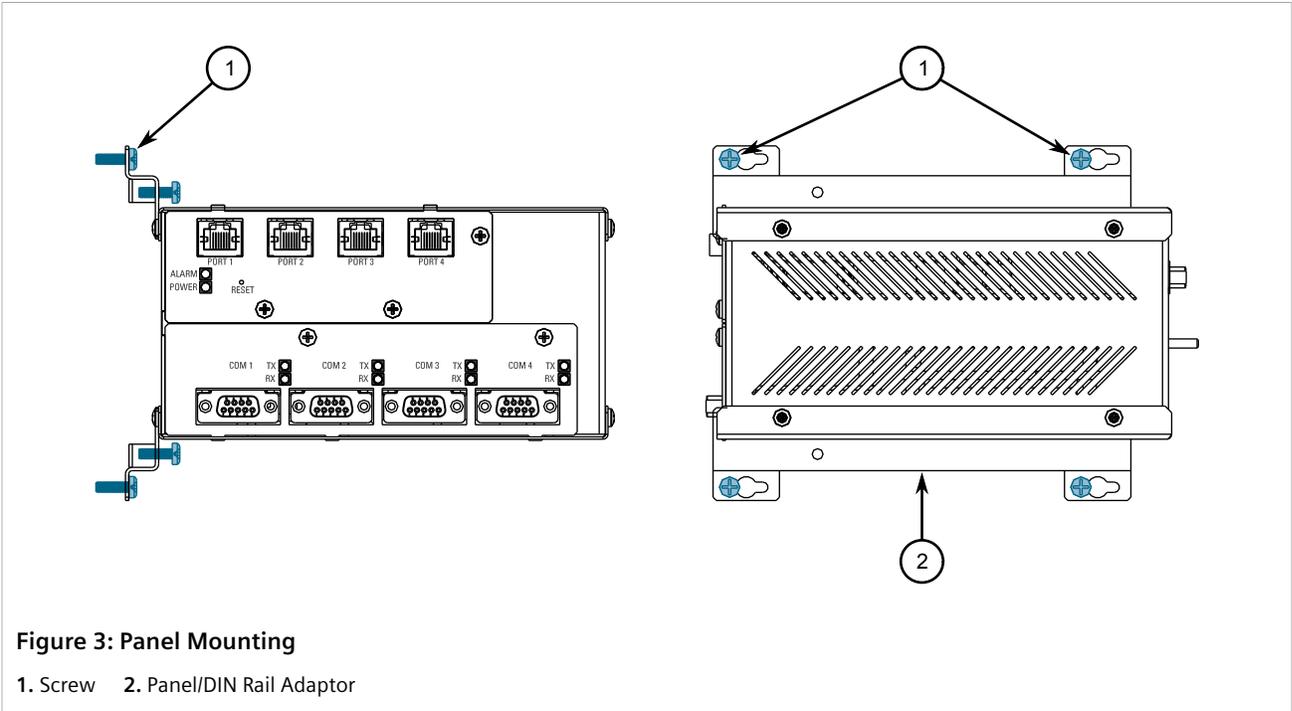
Section 2.1.2

Mounting the Device to a Panel

For panel installations, the RS401 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.



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

Section 2.2

Connecting Power

The RS401 supports a single integrated high AC/DC or low DC power supply



NOTE

- For 88-300 VDC rated equipment, an appropriately rated circuit breaker must be installed.
- For 100-240 VAC rated equipment, an appropriately rated 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 equipment.
- Power input terminals have reverse polarity protection for 12, 24 and 48 VDC rated equipment.
- Equipment must be installed according to applicable local wiring codes and standards.

CONTENTS

- [Section 2.2.1, "Connecting AC Power"](#)

- [Section 2.2.2, "Connecting DC Power"](#)

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. 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/hot (+/H) terminal on the terminal block.

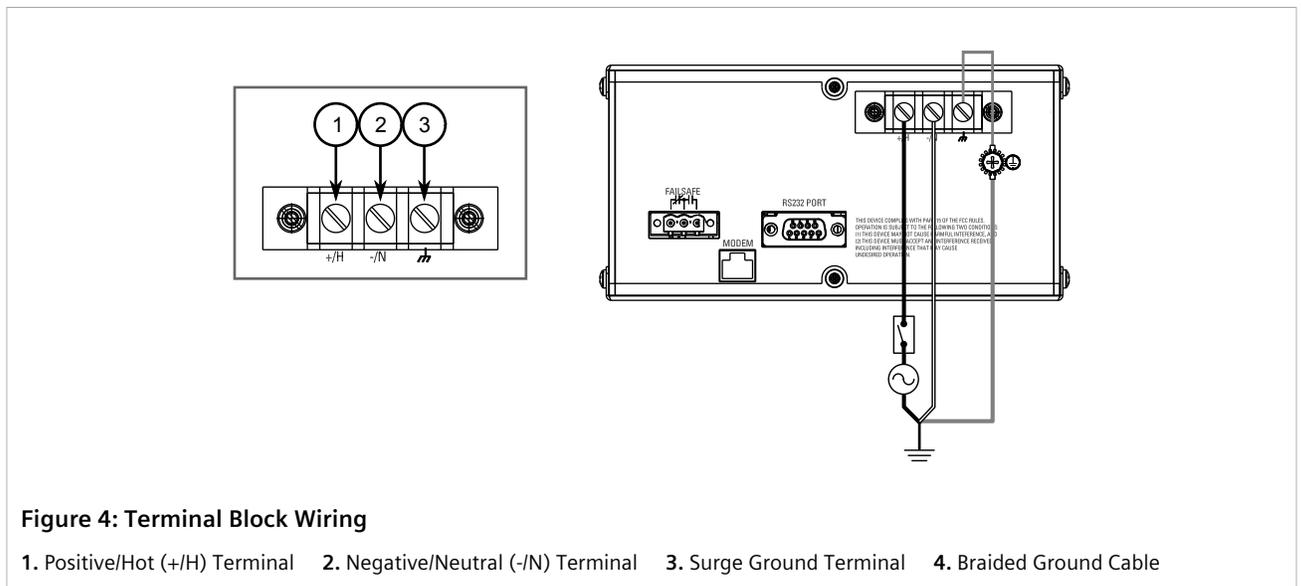


Figure 4: Terminal Block Wiring

1. Positive/Hot (+/H) 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. For more information, refer to [Section 2.4, "Grounding the Device"](#).

Section 2.2.2

Connecting DC Power

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

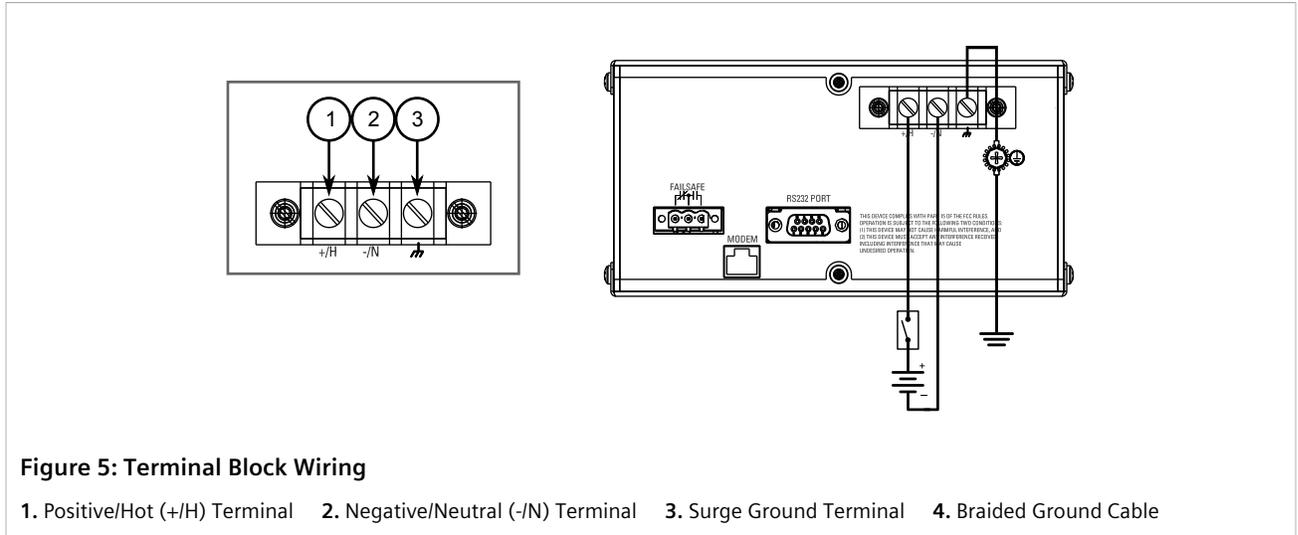


CAUTION!

Electrical hazard – risk of damage to equipment. Before testing the dielectric strength (HIPOT) in the field, remove the 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/hot (+/H) terminal on the terminal block.



2. Connect the negative wire from the power source to the negative/neutral (-/N) 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. For more information, refer to [Section 2.4, "Grounding 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 RS401.

The following shows the proper relay connections.

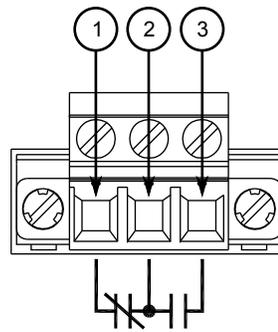


Figure 6: Failsafe Alarm Relay Wiring

1. Normally Open 2. Common 3. Normally Closed

Section 2.4

Grounding the Device

The RS401 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).

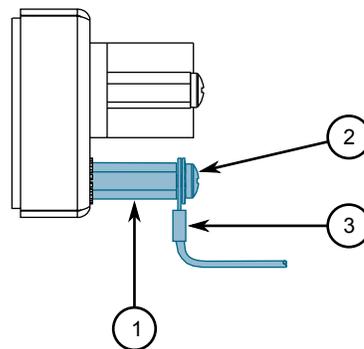


Figure 7: Chassis Ground Connection

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

Section 2.5

Cabling Recommendations

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 ROS console and Web interfaces on the device. For more detailed instructions, refer to the *ROS User Guide* for the RS401.

» Serial Console Port

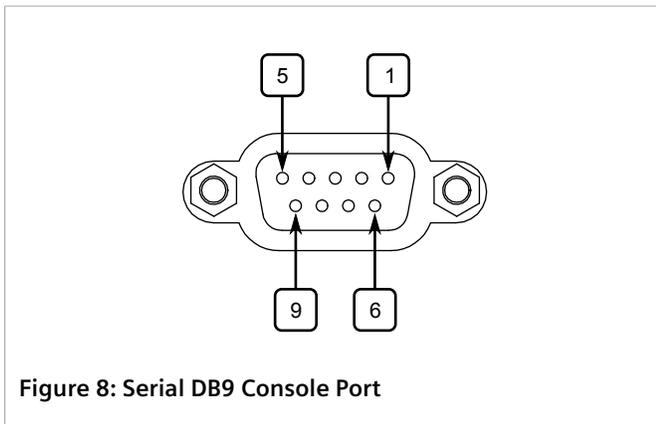
Connect a PC or terminal directly to the serial console port to access the boot-time control and ROS console interface.



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:



Pin	Name	Description
1 ^a		Reserved (Do Not Connect)
2	TX	Transmit Data
3	RX	Receive Data
4 ^a		Reserved (Do Not Connect)
5	GND	Signal Ground
6 ^a		Reserved (Do Not Connect)
7 ^b		Reserved (Do Not Connect)
8 ^b		Reserved (Do Not Connect)
9		Reserved (Do Not Connect)

^a Connected internally.

^b Connected internally.

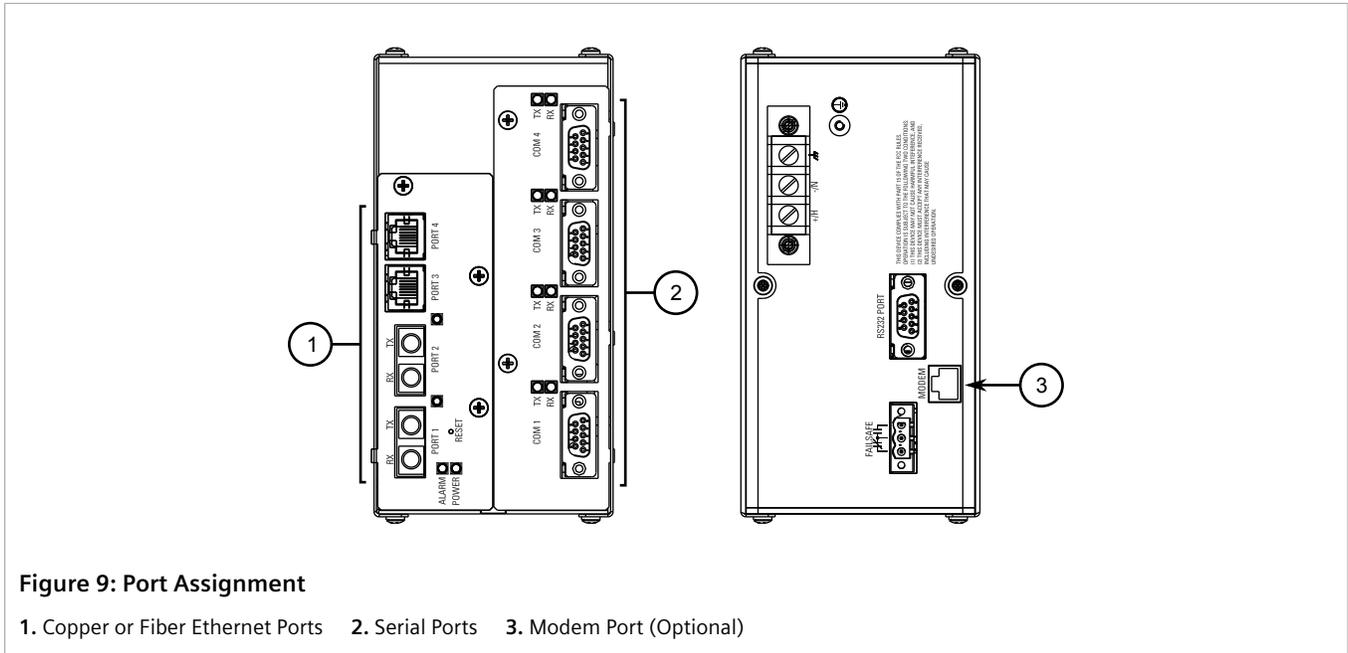
» Communication Ports

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](#).

3 Communication Ports

The RS401 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 RS401.

Each communication port type has a specific place in the RS401 chassis.



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- [Section 3.1, "Copper Ethernet Ports"](#)
- [Section 3.2, "Fiber Optic Ethernet Ports"](#)
- [Section 3.3, "Modem Port"](#)
- [Section 3.4, "Serial Ports"](#)

Section 3.1

Copper Ethernet Ports

The RS401 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.

 **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.

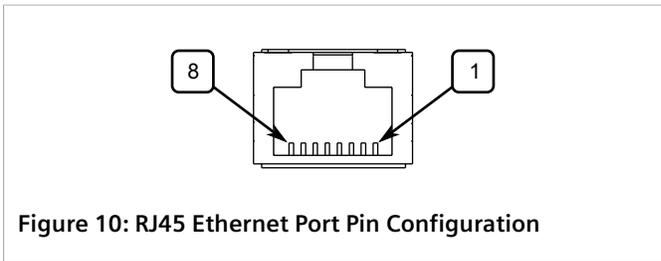
» LEDs

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 maximum speed
	Off	The port is not operating at maximum speed
Link	Yellow (Solid)	Link established
	Yellow (Blinking)	Link activity
	Off	No link detected

» Pin-Out Description

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



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)	

» Specifications

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.

» Port Types

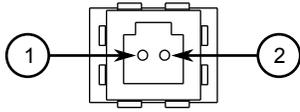


Figure 11: MTRJ Port

1. Tx Connector 2. Rx Connector

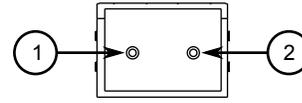


Figure 12: LC Port

1. Tx Connector 2. Rx Connector

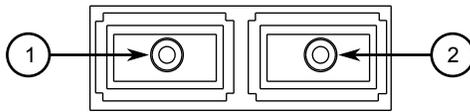


Figure 13: SC Port

1. Tx Connector 2. Rx Connector

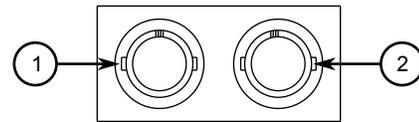


Figure 14: ST Port

1. Tx Connector 2. Rx Connector

» Specifications

For specifications on the available fiber optic Ethernet ports, refer to [Section 4.4, "Fiber Optic Ethernet Port Specifications"](#).

Section 3.3

Modem Port

The RS401 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 *ROS User Guide* for the RS401.



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:

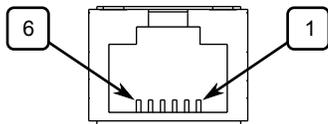


Figure 15: RJ11 Port Pin Configuration

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 3.4

Serial Ports

The RS401 supports RJ45 or DB9 serial ports, 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 RS401.

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

State	Description
Green	Activity detected
Off	No activity

For specifications on serial ports, refer to [Section 4.5, "Serial Port Specifications"](#).

CONTENTS

- [Section 3.4.1, "Serial RS232 DB9 Ports"](#)
- [Section 3.4.2, "Serial RS232/RS485/RS422 DB9 Ports"](#)
- [Section 3.4.3, "Serial RS232/RS485/RS422 RJ45 Ports"](#)
- [Section 3.4.4, "Serial Insulated Terminals"](#)
- [Section 3.4.5, "Connecting Multiple RS485 Devices"](#)

Section 3.4.1

Serial RS232 DB9 Ports

Serial RS232 DB9 ports offer a female Data Communications Equipment (DCE) interface. When communicating with a Data Terminal Equipment (DTE) device, such as a PC, a straight-through serial cable (3 pin or 9 pin) is required. When communicating with another DCE device, such as another RS401, the RX and TX pins must be *crossed-over* using, for example, a NULL modem cable.

The following is the pin-out description for the RS232 DB9 ports:

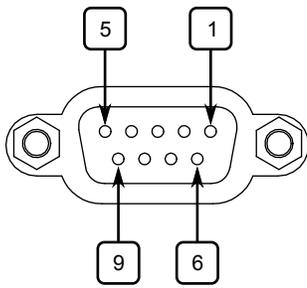


Figure 16: RS232 DB9 Serial Console Port

Pin	Name	Description
1		Reserved (Do Not Connect)
2	TX	Transmit Data
3	RX	Receive Data
4		Reserved (Do Not Connect)
5	GND	Common Ground
6		Reserved (Do Not Connect)
7		Reserved (Do Not Connect)
8		Reserved (Do Not Connect)
9		Reserved (Do Not Connect)

Section 3.4.2

Serial RS232/RS485/RS422 DB9 Ports

The RS401 can be equipped with serial RS232/RS485/RS422 DB9 ports. Each port can be set individually through the ROS operating system to operate in RS232, RS485 or RS422 mode. For more information, refer to the *ROS User Guide* for the RS401.

The following is the pin-out description for the RS232/RS485/RS422 DB9 ports:

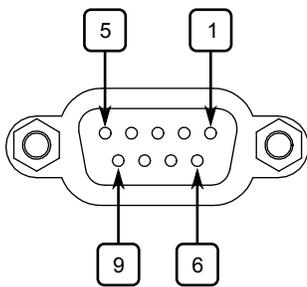


Figure 17: RS232/RS485/RS422 DB9 Serial Console Port

Pin ^a	Name		
	RS232 Mode	RS485 Mode	RS422 Mode
1	CD (No Connection)	—	—
2	TX	TX/RX+	TX+
3	RX	—	RX+
4	DTR (No Connection)	—	—
5	Common (Isolated Ground) ^b		
6	DSR (No Connection)	—	RX-
7	CTS ^c	TX/RX-	TX-
8	RTS ^c	—	—
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 Pins 7 and 8 are connected together internally. In RS232 mode, these pins enter a high impedance state. A DTE that asserts RTS will see CTS asserted, although the device will not perform hardware flow control.

Section 3.4.3

Serial RS232/RS485/RS422 RJ45 Ports

The RS401 can be equipped with serial RS232/RS485/RS422 RJ45 ports. Each port can be set individually through the ROS operating system to operate in RS232, RS485 or RS422 mode. For more information, refer to the *ROS User Guide* for the RS401.

The following is the pin-out description for the RS232/RS485/RS422 RJ45 ports:

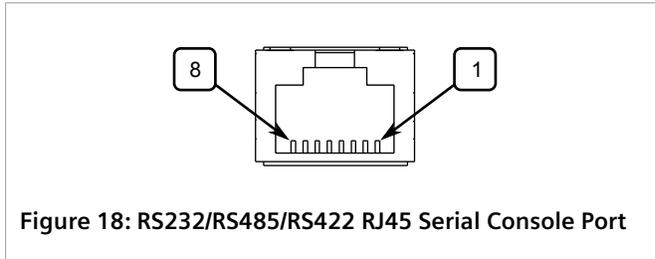


Figure 18: RS232/RS485/RS422 RJ45 Serial Console Port

Pin ^d	Name		
	RS232 Mode	RS485 Mode	RS422 Mode
1	DSR ^e		RX-
2	DCD ^e		
3	DTR ^e		
4	Common (Isolated) Ground		
5	RXD ^f		RX+
6	TXD ^f	TX/RX+	TX+
7	CTS		
8	RTS	TX/RX-	TX-
Shield	Chassis Ground		

^d No internal termination is provided.

^e The DSR, DCD and DTR pins are connected together internally.

^f In RS232 mode, the RJ45 ports conform to EIA-561 DTE, which transmit on TXD and receive on RXD.

Section 3.4.4

Serial Insulated Terminals

The RS401 can be equipped with serial RS485 insulated terminals. The terminals are terminated by default from the factory. Termination provided is AC Termination style 120 Ohm resistor in series with a 10nF capacitor. The following details the appropriate jumper configuration for each RS485 port.

Port	Jumper Number	Jumper Position	
		No Termination	AC Termination
1	JP5	Removed	Installed
2	JP6		
3	JP7		
4	JP8		

The following is the pin-out description for the RS485 insulated terminals:

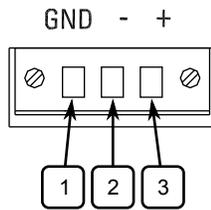


Figure 19: Serial Insulated Terminal Port

Terminal	Description
1	Positive
2	Negative
3	Common (Isolated Ground)

Section 3.4.5

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.

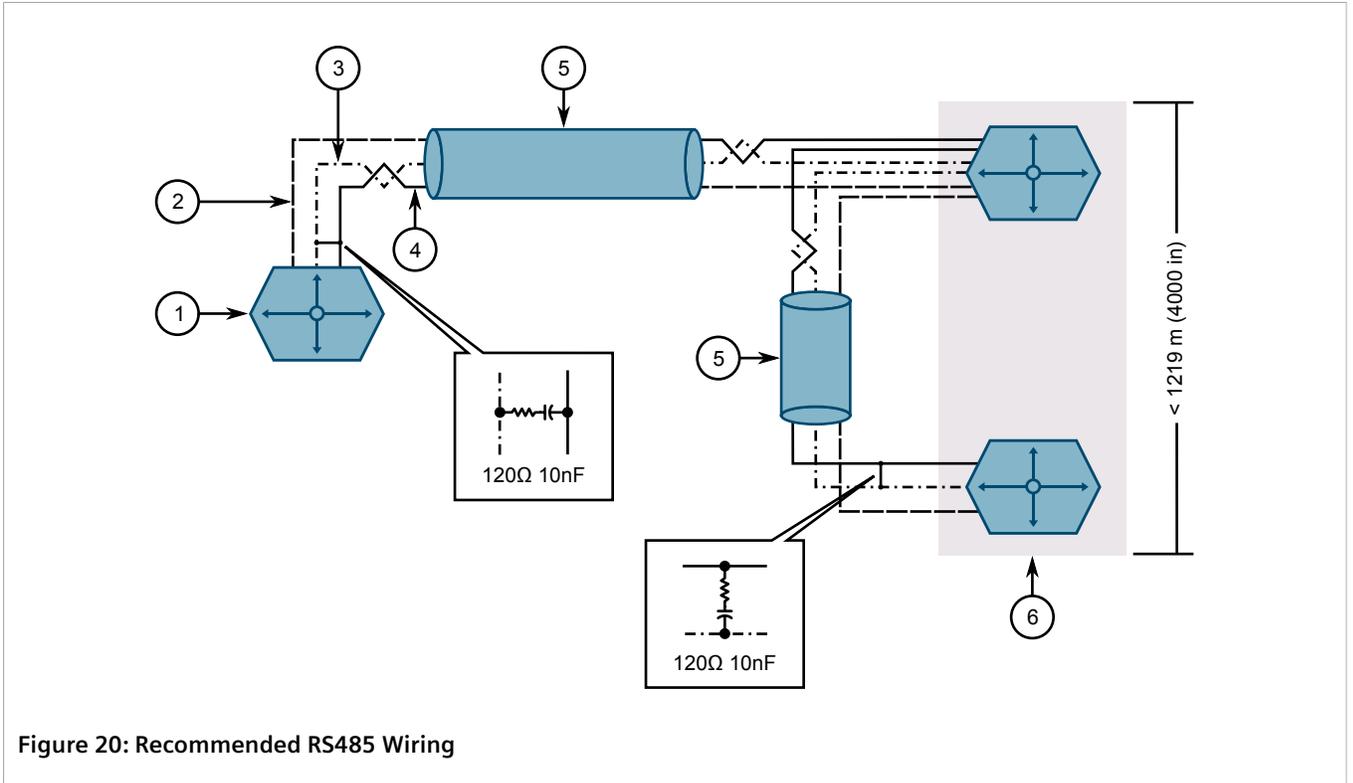


Figure 20: Recommended RS485 Wiring

4 Technical Specifications

This section details the specifications and operating conditions of the device.

CONTENTS

- [Section 4.1, "Power Supply Specifications"](#)
- [Section 4.2, "Failsafe Alarm Relay Specifications"](#)
- [Section 4.3, "Copper Ethernet Port Specifications"](#)
- [Section 4.4, "Fiber Optic Ethernet Port Specifications"](#)
- [Section 4.5, "Serial Port Specifications"](#)
- [Section 4.6, "Operating Environment"](#)
- [Section 4.7, "Mechanical Specifications"](#)

Section 4.1

Power Supply Specifications

Power Supply Type	Minimum Input	Maximum Input	Internal Fuse Rating	Maximum Power Consumption
12-24 VDC	10 VDC	36 VDC	6.3 A(F) ^a	8 W
48 VDC	36 VDC	59 VDC	2 A(T) ^a	
HI (125/250 VDC) ^b	88 VDC	300 VDC	2 A(T) ^{a b}	
HI (110/230 VAC) ^b	85 VAC	265 VAC		

^a (F) denotes fast-acting fuse; (T) denotes time-delay fuse.

^b This is the same power supply for both AC and DC.

Section 4.2

Failsafe Alarm Relay Specifications

Parameter	Value
Max Switching Voltage	30 VAC, 80 VDC, 125 VAC, 250 VAC
Rated Switching Current	0.3 A @ 30 VAC 1 A @ 30 VDC, 0.3 A @ 80 VDC 0.2 A @ 250 VAC 0.6 A @ 125 VAC

Section 4.3

Copper Ethernet Port Specifications

The following details the specifications for copper Ethernet ports that can be ordered with the RS401.

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

^c Auto-negotiating.

^d Shielded or unshielded.

^e Auto-crossover and auto-polarity.

^f RMS 1 minute.

Section 4.4

Fiber Optic Ethernet Port Specifications

The following sections detail fiber optic specifications for ports that can be equipped on the RUGGEDCOM RS401.

CONTENTS

- [Section 4.4.1, "10BaseFL Ethernet Optical Specifications"](#)
- [Section 4.4.2, "Fast Ethernet \(100 Mbps\) Optical Specifications"](#)

Section 4.4.1

10BaseFL Ethernet Optical Specifications

Mode	Connector	Tx λ (nm)	Cable Type (um) ^g	Tx Min (dBm peak) ^g	Tx Max (dBm peak) ^g	Rx Sensitivity (dBm Average) ^g	Rx Saturation (dBm Peak) ^g	Typical Distance (km) ^h	Power Budget (dB)
MM	ST	820	50/125	-19.8	-12.8	-34	-11.2	2	18
			62.5/125	-16	-9				

^g To convert from average to peak, add 3 dBm. To convert from peak to average, subtract 3 dBm.

^h 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.

Section 4.4.2

Fast Ethernet (100 Mbps) Optical Specifications

Mode	Connector	Tx λ (nm)	Cable Type (um) ⁱ	Tx Min (dBm peak) ⁱ	Tx Max (dBm peak) ⁱ	Rx Sensitivity (dBm Average) ⁱ	Rx Saturation (dBm Peak) ⁱ	Typical Distance (km) ^j	Power Budget (dB)
MM	ST	1300	50/125	-22.5	-14	-33.9	-14	2	14.9
			62.5/125	-19	-14				11.4
MM	SC	1300	50/125	-22.5	-14	-33.9	-14	2	14.9
			62.5/125	-19	-14				
MM	MTRJ	1300	50/125	-22.5	-14	-33.5	-14	2	11
			62.5/125	-19	-14				
SM	ST	1310	9/125	-15	-7	-34	-3	20	19
SM	SC	1300	9/125	-15	-8	-31	-7	20	16
SM	SC	1310	9/125	-5	0	-34	-3	50	29
SM	SC	1310	9/125	0	5	-37	0	90	42
SM	LC	1300	9/125	-15	-8	-38	-3	20	23
SM	LC	1310	9/125	-5	0	-35	-3	50	30
SM	LC	1310	9/125	0	5	-37	0	90	37

ⁱ To convert from average to peak, add 3 dBm. To convert from peak to average, subtract 3 dBm.

^j 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.

Section 4.5

Serial Port Specifications

Port Type	Media	Distance	Connector Type
RS232	Standard RS232 Shielded Serial Cable	15 m (49 ft)	DB9
RS485	Shielded Twisted-Pair	1200 m (3937 ft)	Insulated Terminals
RS232/RS485/RS422	Shielded Twisted-Pair	1200 m (3937 ft)	DB9
RS232/RS485/RS422	Shielded Twisted-Pair	1200 m (3937 ft)	RJ45

Section 4.6

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 4.7

Mechanical Specifications

Parameter	Value
Dimensions	Refer to Chapter 5, Dimension Drawings
Weight	1.9 kg (4.2 lb)
Enclosure	18 AWG Galvanized Steel

5 Dimension Drawings



NOTE

All dimensions are in millimeters, unless otherwise stated.

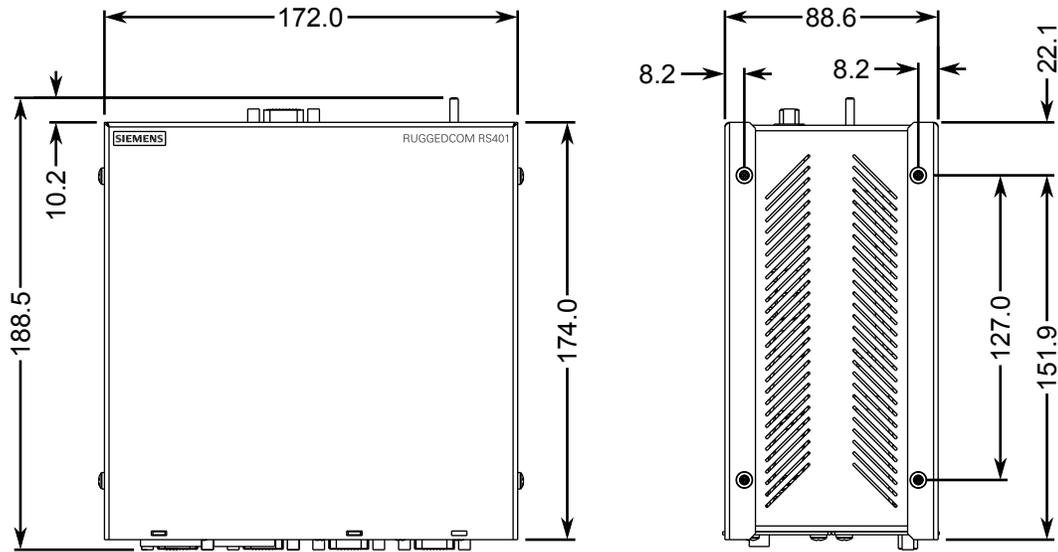


Figure 21: Overall Dimensions

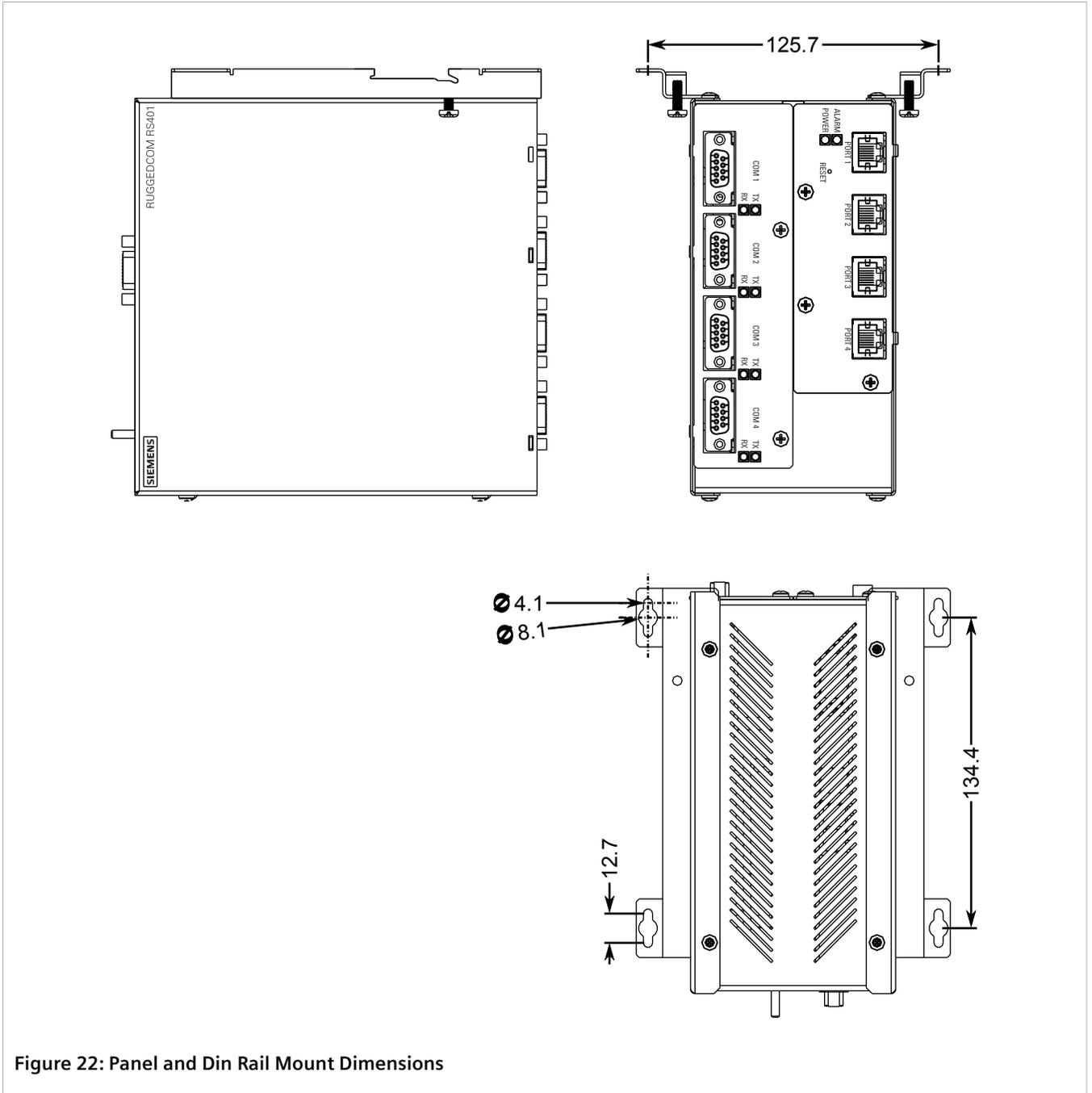


Figure 22: Panel and Din Rail Mount Dimensions

6 Certification

The RUGGEDCOM RS401 device has been thoroughly tested to guarantee its conformance with recognized standards and has received approval from recognized regulatory agencies.

CONTENTS

- [Section 6.1, "Agency Approvals"](#)
- [Section 6.2, "FCC Compliance"](#)
- [Section 6.3, "Industry Canada Compliance"](#)
- [Section 6.4, "EMI and Environmental Type Tests"](#)

Section 6.1

Agency Approvals

Agency	Standards	Comments
CSA	CSA C22.2 No. 60950-1, UL 60950-1	Approved
FCC	FCC Part 15, Class A	Approved
FDA/CDRH	21 CFR Chapter I, Sub-chapter J	Approved
CE	EN 60950-1, EN 61000-6-2, EN55022, EN 60825-1, EN 50581	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 RS401 has passed the following EMI and environmental tests.

» IEC 61850-3 EMI 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	
IEC 61000-4-4	Burst (Fast Transient)	Signal ports	+/- 4 kV @ 2.5 kHz	
		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
		D.C 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 & 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	
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
IEC 60255-5	Dielectric Strength	Signal ports	2 kVac (Fail-Safe Relay output)	
		DC Power ports	1.5 kVDC	
		AC Power ports	2 kVAC	
	H.V. Impulse	Signal ports	5 kV (Fail-Safe Relay output)	

Test	Description		Test Levels	Severity Levels
		DC Power ports	5 kV	
		AC Power ports	5 kV	

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



NOTE

The RS401 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
C37.90.1	7	Oscillatory	Signal ports	2.5 kV common mode @ 1 MHz
			DC Power ports	2.5 kV common and differential mode @ 1 MHz
			AC Power ports	2.5 kV common and differential mode @ 1 MHz
C37.90	6	Dielectric Strength	Signal ports	2 kVAC
			DC Power ports	1.5 kVDC
			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

