SIEMENS

RUGGEDCOM RX1512

Installation Guide

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For warranty details, visit www.siemens.com/ruggedcom or contact a Siemens customer service representative.

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Table of Contents

Preface

This guide describes the RUGGEDCOM RX1512. 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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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 II User Guide for the RX1512*

Accessing Documentation

The latest user documentation for RUGGEDCOM RX1512 v is available online at www.siemens.com/ruggedcom. To request or inquire about a user document, contact Siemens Customer Support.

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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.

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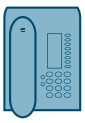
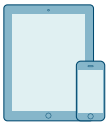
Online
Visit http://www.siemens.com/automation/support-request to submit a Support Request (SR) or check on the status of an existing SR.



Telephone
Call a local hotline center to submit a Support Request (SR). To locate a local hotline center, visit http://www.automation.siemens.com/mcms/aspa-db/en/automation-technology/Pages/default.aspx.



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Install the Industry Online Support app by Siemens AG on any Android, Apple iOS or Windows mobile device and be able to:

- 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 RX1512 is a cost-efficient, rugged Layer 3 switch and router. The RX1512's modular and field replaceable platform can be equipped with WAN, serial, and Ethernet options, making it ideally suited for electric power utilities, the industrial plant floor, and traffic control systems. The appliance's compact form factor makes it ideal for pole mount applications or installation in restricted spaces.

The RX1512 is designed to provide 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 RX1512 to be placed in almost any location.

The following sections provide more information about the RX1512:

Section 1.1

Feature Highlights

Reliability in Harsh Environments

- Immunity to EMI and high voltage electrical transients
- -40 to 85 °C (-40 to 185 °F) operating temperature (no fans)
- Failsafe output relay for critical failure or error alarming

Physical Ports

- Field replaceable line modules
- Up to 12 100Base-FX ports
- Up to 12 10/100Base-TX ports
- Up to 6 10Base-FL/100Base-SX ports
- Up to 4 Gigabit Ethernet ports
- Up to 12 serial ports
- Up to 4 T1/E1 RJ48C ports or 2 E1 BNC ports
- Up to 2 DDS (Digital Data Services) ports
- Up to 2 cellular SMA antenna ports (HSPA/EVDO)

Universal Power Supply Options

- Fully integrated power supply (no external adapter)
- Input voltage range: 11-72 VDC
- CSA/UL 60950-1 safety approved to 85 °C (185 °F)

Section 1.2
Description

The RX1512 features various ports, controls and indicator LEDs on the front panel for connecting, configuring and troubleshooting the device.

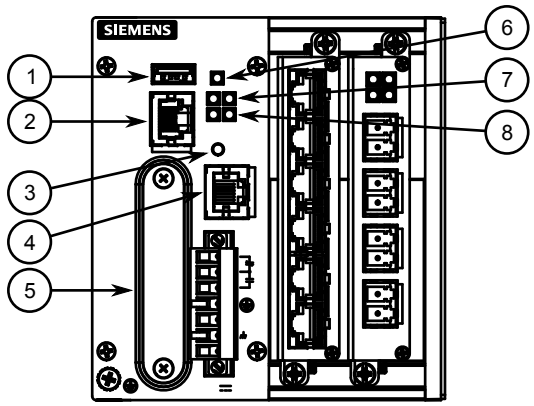

Figure 1: RUGGEDCOM RX1512

1. Utility USB Port **2.** RS232 Serial Console Port (RJ45) **3.** Lamp Test/Alarm Cut-Off (LT/ACO) Button **4.** Management Port **5.** Compact Flash Card Port **6.** Alarm Indicator LED **7.** Power Status LEDs **8.** Port Status LEDs

- **Management Port** – This 10/100Base-T Ethernet port is used for system management that is out-of-band from the switch fabric.
- **RS-232 Serial 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”.
- **Utility USB Port** – Use the USB port to upgrade the ROX II software or install files, such as configuration files and feature key files. For more information, refer to the *RUGGEDCOM ROX II User Guide* for the RUGGEDCOM RX1512.
- **Lamp Test/Alarm Cut-Off (LT/ACO) Button** – This button performs two functions:
  - Press and hold this button to test all indicator LEDs
  - Press and release this button to acknowledge an active alarm
- **Power Status LEDs** – Indicate the status of the power modules.
  - I = The power supply is receiving power
  - O = The power supply is supplying power
- **Port Status LEDs** – Indicate when ports are active.
  - Green = OK
  - Orange = Warning alert
  - Red = Configuration error
- **Alarm Indicator LED** – Indicates when an alarm condition exists.
  - Green = Alarms cleared/acknowledged
  - Red = Alarm

- **Compact Flash Card Port** – Houses the 1 GB compact flash card that contains active and backup installations of RUGGEDCOMROX II, along with the configuration database and other system data.

CAUTION!
Configuration hazard – risk of data corruption/loss. Do not open the compact flash card port, unless specifically instructed to by a Siemens Customer Support representative. The warranty will be void otherwise. Removing the compact flash card improperly can corrupt configuration data.

2 Installing the Device

The following sections describe how to install the device, including mounting the device, 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 RX1512 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”
- 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 RX1512 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.

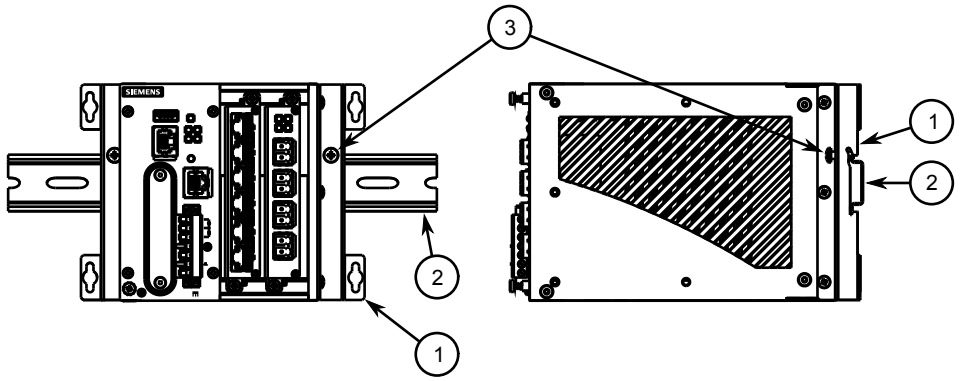

Figure 2: DIN Rail Mounting

1. Panel/DIN Rail Adapter **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 2.1.2
Mounting the Device to a Panel

For panel installations, the RX1512 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.

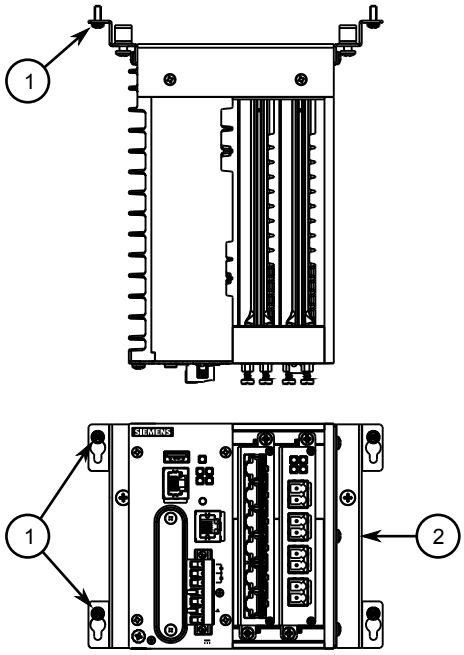

Figure 3: Panel Mounting

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

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

Section 2.2

Connecting Power

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

CAUTION!
Electrical hazard – risk of damage to equipment. Do not connect AC power cables to a 12, 24 or 48 VDC power supply terminal block. Damage to the power supply may occur.

IMPORTANT!
When connecting the device to a DC power source, make sure the source provides only positive voltage.

IMPORTANT!

- *Use only #16 gage copper wiring when connecting terminal blocks.*
- *It is recommended to provide a 20 A circuit breaker for the power supply.*
- *Equipment must be installed according to applicable local wiring codes and standards.*
- *Make sure the DC power source provides only positive voltage.*

CAUTION!
Electrical hazard – risk of damage to equipment. In normal operation, the jumper between the chassis ground and surge ground terminals must be installed for proper operation. Damage to the device may occur otherwise. Removing the jumper may also void the warranty.

NOTE
For information about how to safely test the dielectric strength of the device, refer to Section 2.3, "Testing Dielectric Strength".

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

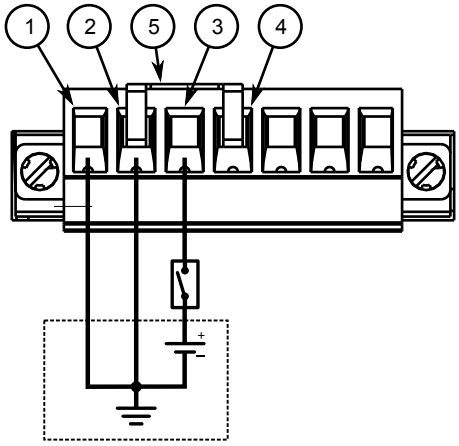

Figure 4: DC Terminal Block Wiring

1. Negative (-) Terminal **2.** Chassis Ground Terminal **3.** Positive (+) Terminal **4.** Surge Ground Terminal **5.** Jumper

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 chassis 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 2.5, "Grounding the Device".

Section 2.3
Testing Dielectric Strength

Before performing any dielectric strength or HIPOT (High Potential) testing on the RUGGEDCOM RX1512 in the field, do the following:

IMPORTANT!
In normal operation, the jumper between the chassis ground and surge ground terminals must be installed for proper operation. Removing the jumper may void the warranty.

CAUTION!
Electrical hazard – risk of damage to equipment. Before testing the dielectric strength (HIPOT), remove the metal jumper. Damage to equipment may occur.

1. Remove the metal jumper that connects surge ground terminal and the chassis ground terminal. 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.

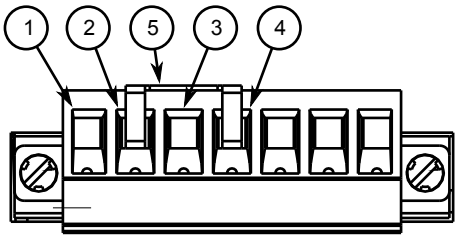

Figure 5: Jumper

1. Negative (-) Terminal **2.** Chassis Ground Terminal **3.** Positive (+) Terminal **4.** Surge Ground Terminal **5.** Jumper

2. Connect one terminal from the HIPOT tester to the positive terminal and the negative terminal. Connect the second terminal of the HIPOT tester to chassis ground terminal. Do not connect the HIPOT tester to surge ground terminal.
3. Following the test, install the metal jumper between the surge ground terminal and the chassis ground terminal.

Section 2.4
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 II. One common application for this relay is to signal an alarm if a power failure occurs. For more information, refer to the ROX II User Guide for the RX1512.

The following shows the proper relay connections.

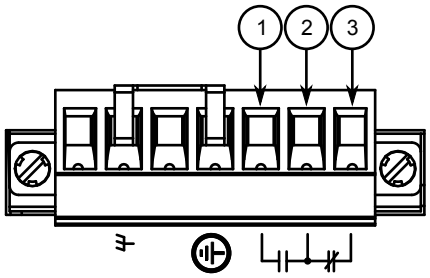

Figure 6: Failsafe Alarm Relay Wiring

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

Section 2.5

Grounding the Device

The RX1512 chassis ground terminal uses a #10-32 screw. It is recommended to terminate the ground connection with a #10 ring lug and torque it to 3.4 N·m (30 lbf·in).

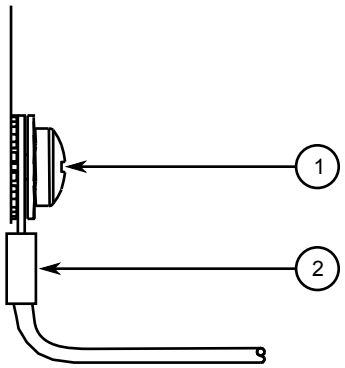

Figure 7: Chassis Ground Connection

1. #10-32 Screw **2.** #10 Ring Lug

Section 2.6

Connecting to the Device

The following describes the various methods for accessing the ROX II console and Web interfaces on the device. For more detailed instructions, refer to the *ROX II User Guide* for the RX1512.

Serial Console and Management Ports

Connect a PC or terminal directly to the serial console or management ports to access the boot-time control and ROX II interfaces. The serial console port provides access to ROX II's console interface, while the management port provides access to ROX II's console and Web interfaces.

IMPORTANT!
The serial console and management (MGMT) ports are intended to be used only as temporary connections during initial configuration or troubleshooting.

Connection to the console port is made using an RJ-45-to-DB9 console cable. The following is the pin-out for the console port:

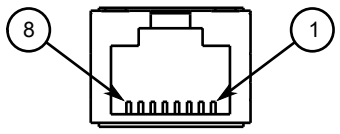

Figure 8: RJ-45 Console Port Pin Configuration

Pin		Name	Description
RJ-45 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
	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.*

For information about how to connect to the device via the serial console port, refer to the *RUGGEDCOM ROX II CLI User Guide* for the RX1512.

For information about how to connect to the device via the management port, refer to either the *RUGGEDCOM ROX II Web Interface User Guide* or the *RUGGEDCOM ROX II CLI User Guide* for the RX1512.

The management port is a 10/100Base-TX copper Ethernet port with an RJ-45 connector. The following is the pin-out for the management port:

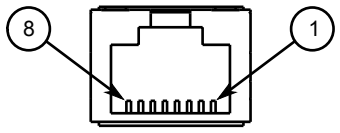

Figure 9: RJ-45 Management Port

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)	

Pin	Name	Description
8	Reserved (Do Not Connect)	

Communication Ports

Connect any of the available Ethernet ports on the device to a management switch and access the ROX II console and Web interfaces via the device's IP address. The factory default IP address for the RUGGEDCOM RX1512 is https://192.168.0.2.

For more information about available ports, refer to Chapter 3, *Communication Ports*.

Section 2.7

Cabling Recommendations

Siemens recommends using SIMATIC NET industrial Ethernet shielded cables for all Ethernet ports.

Refer to the following sections for further recommendations and considerations:

- Section 2.7.1, “Protection On Twisted-Pair Data Ports”
- Section 2.7.2, “Gigabit Ethernet 1000Base-TX Cabling Recommendations”

Section 2.7.1

Protection On Twisted-Pair Data Ports

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 2.7.2

Gigabit Ethernet 1000Base-TX Cabling Recommendations

The IEEE 802.3ab Gigabit Ethernet standard defines 1000 Mbit/s Ethernet communications over distances of up to 100 m (328 ft) using all 4 pairs in category 5 (or higher) balanced, unshielded twisted-pair cabling. For wiring guidelines, system designers and integrators should refer to the Telecommunications Industry Association (TIA) TIA/EIA-568-A wiring standard that characterizes minimum cabling performance specifications required for proper Gigabit Ethernet operation. For reliable, error-free data communication, new and pre-existing communication paths should be verified for TIA/EIA-568-A compliance.

The following table summarizes the relevant cabling standards:

Cabling Category	1000Base-TX Compliant	Required Action
< 5	No	New wiring infrastructure required.

Cabling Category	1000Base-TX Compliant	Required Action
5	Yes	Verify TIA/EIA-568-A compliance.
5e	Yes	No action required. New installations should be designed with Category 5e or higher.
6	Yes	No action required.
> 6	Yes	Connector and wiring standards to be determined.

Follow these recommendations for copper data cabling in high electrical noise environments:

- Data cable lengths should be as short as possible, preferably 3 m (10 ft) in length. Copper data cables should not be used for inter-building communications.
- Power and data cables should not be run in parallel for long distances, and should be installed in separate conduits. Power and data cables should intersect at 90° angles when necessary to reduce inductive coupling.

3 Communication Ports

The RX1512 can be equipped with various types of communication ports to enhance its abilities and performance. Each set of communication ports is part of a field replaceable module that makes switching ports fast and easy.

Use the ROX II software to determine which ports are equipped on the device. For more information, refer to the *ROX II User Guide* for the RX1512.

Modules can be installed in any one of the available slots in the RX1512 chassis.

NOTE
Only one T1/E1 module is allowed.

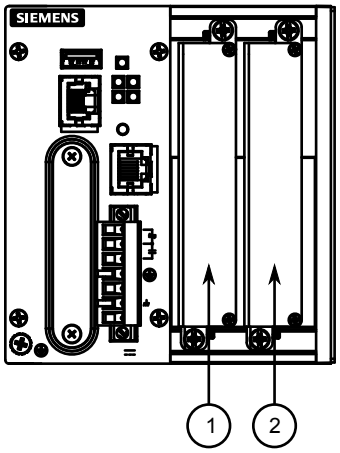

Figure 10: Available Chassis Slots

1. Slot 1 **2.** Slot 2

The following sections describe the available ports in more detail:

Section 3.1
Copper Ethernet Ports

The RX1512 supports several 10/100Base-TX Ethernet ports with RJ-45 or M12 (bypass or non-bypass) connectors. The RJ-45 and M12 connectors are directly connected to the chassis ground on the device and can accept CAT-5 shielded twisted-pair (STP) cables.

CAUTION!
Contamination hazard – risk of damage to equipment. M12 modules are shipped with internal O-rings and dust caps to prevent the ingress of dirt and debris that may damage the port. Make sure the O-rings and dust caps are installed on all unused M12 ports.

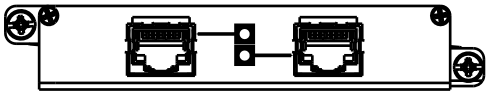

Figure 11: 2 × 10/100/1000TX with RJ-45 Ports

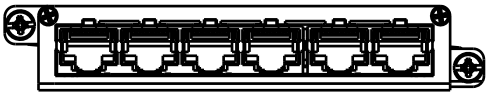

Figure 12: 6 × 10/100TX with RJ-45 Ports

Figure 13: 2 x 8-Pin 10/100/1000TX with M12 A-Coded Ports

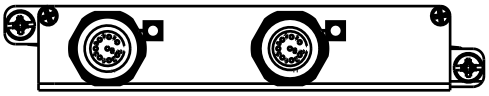

Figure 14: 2 x 8-Pin 10/100/1000TX with M12 A-Coded Bypass Ports

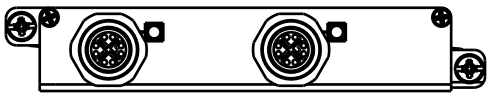

Figure 15: 2 x 8-Pin 10/100/1000TX with M12 X-Coded Ports

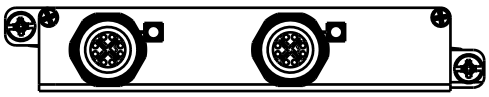

Figure 16: 2 x 8-Pin 10/100/1000TX with M12 X-Coded Bypass Ports

Figure 17: 4 x 8-Pin 10/100TX with M12 A-Coded Ports

Figure 18: 4 x 8-Pin 10/100TX with M12 A-Coded Bypass and Non-Bypass Ports

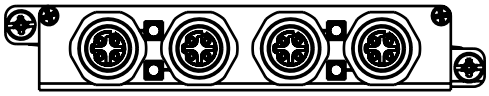

Figure 19: 4 x 4-Pin 10/100TX M12 D-Coded Ports

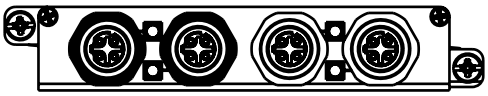

Figure 20: 4 x 4-Pin 10/100TX with M12 D-Coded Bypass and Non-Bypass Ports

Each port features an LED that indicates the state of the port.

State	Description
Green (Solid)	Link established
Green (Blinking)	Activity
Off	No link detected

The following are the pin-out descriptions for the RJ-45 and M12 connectors:

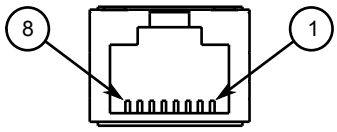

Figure 21: RJ-45 Ethernet Port Pin Configuration

Pin	Name		Description
	10/100Base-TX	1000Base-TX	
1	RX+	BI_DA+	Receive Data+ or Bi-Directional Pair A+
2	RX-	BI_DA-	Receive Data- or Bi-Directional Pair A-
3	TX+	BI_DB+	Transmit Data+ or Bi-Directional Pair B+
4	Reserved (Do Not Connect)	BI_DC+	Transmit Data+ or Bi-Directional Pair C+
5	Reserved (Do Not Connect)	BI_DC-	Receive Data- or Bi-Directional Pair C-
6	TX-	BI_DB-	Transmit Data- or Bi-Directional Pair B-
7	Reserved (Do Not Connect)	BI_DD+	Receive Data- or Bi-Directional Pair D+
8	Reserved (Do Not Connect)	BI_DD-	Receive Data- or Bi-Directional Pair D-

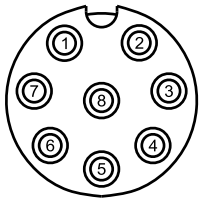

Figure 22: 8-Pin M12 A-Coded Ethernet Port Pin Configuration

Pin	10/100Base-Tx Signal	10/100/1000Base-Tx Signal
1	Reserved (Do Not Connect)[a]	C+
2	Reserved (Do Not Connect)[a]	D+
3	Reserved (Do Not Connect)[a]	D-
4	TX-	A-
5	RX+	B+
6	TX+	A+
7	Reserved (Do Not Connect)[a]	C-
8	RX-	B-

Figure 23: 8-Pin M12 X-Coded Ethernet Port Pin Configuration

Pin	10/100/1000Base-Tx Signal
1	A+
2	A-
3	B+
4	B-
5	D+
6	D-
7	C+
8	C-

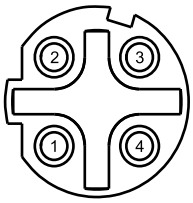

Figure 24: 4-Pin M12 D-Coded Ethernet Port Pin Configuration

Pin	10/100Base-Tx Signal
1	TX+
2	RX+
3	TX-
4	RX-

[a] *Terminated at GND (Ground)*

For specifications on the available copper Ethernet ports, refer to Section 4.4, “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.

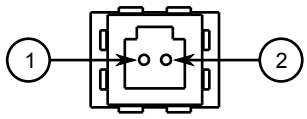

Figure 25: MTRJ Port

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

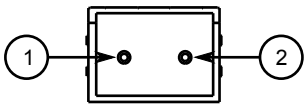

Figure 26: LC Port

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

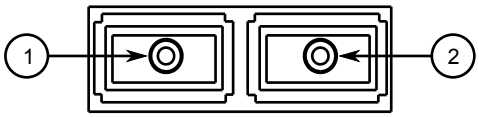

Figure 27: SC Port

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

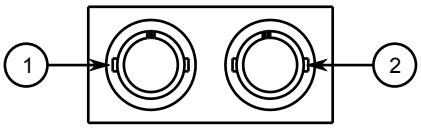

Figure 28: ST Port

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
SFP Optic Ethernet Ports

SFP (Small Form-Factor Pluggable) optic Ethernet ports are available with LC (Lucent Connector) connectors. Make sure the Transmit (Tx) and Receive (Rx) connections of each port are properly connected and matched to establish a proper link.

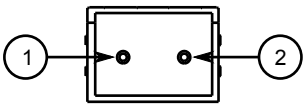

Figure 29: LC Port

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

NOTE
SFP modules, as well as their optical ports, can be safely inserted and removed while the chassis is powered and operating.

The following sections describe how to install and remove SFP optical ports:

Section 3.3.1

Installing an SFP Optical Port

To install an SFP optical port, do the following:

CAUTION!
Electrical hazard – risk of damage to equipment. Use only components certified by Siemens with RUGGEDCOM products. Damage to the module and device may occur if compatibility and reliability have not been properly assessed.

CAUTION!
Electrical hazard – risk of damage to equipment. Make sure all electrostatic energy is dissipated before installing or removing components from the device. An electrostatic discharge (ESD) can cause serious damage to the component once it is outside the chassis.

1. Make sure all potential electrostatic build-up has been properly discharged to prevent electrostatic discharges (ESD). This can be accomplished by wearing an ESD wrist strap or by touching Earth or the chassis ground.
2. Remove the dust cover from the port opening in the module.

   CAUTION!
   Mechanical hazard – risk of component damage. SFP optical ports are designed to insert in only one orientation. Do not force the port into the module.
3. Remove the port from its packaging.
4. Insert the port into the module and swing the bail-latch up to lock it in place.

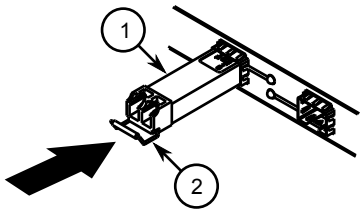

Figure 30: Installing an SFP Optical Port (Typical)

1. SFP Optical Port **2.** Metal Bail-Latch

5. Remove the dust cover from the port.
6. Connect a cable to the port and test the connection.

Section 3.3.2
Removing an SFP Optical Port

To remove an SFP optical port, do the following:

CAUTION!
Electrical hazard – risk of damage to equipment. Make sure all electrostatic energy is dissipated before performing installing or removing components from the device. An electrostatic discharge (ESD) can cause serious damage to the component once it is outside the chassis.

1. Make sure all potential electrostatic build-up has been properly discharged to prevent electrostatic discharges (ESD). This can be accomplished by wearing an ESD wrist strap or by touching Earth or the chassis ground.
2. Disconnect the cable from the port.
3. Swing the metal bail-latch down and pull the port from the module.

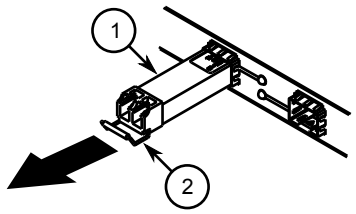

Figure 31: Removing an SFP Optical Port (Typical)

1. SFP Optical Port **2.** Metal Bail-Latch

4. Store the port in an ESD-safe bag or other suitable ESD-safe environment, free from moisture and stored at the proper temperature (-40 to 85 °C or -40 to 185 °F).
5. Insert a plug in the empty port opening to prevent the ingress of dust and dirt.

Section 3.4
WAN Modules

The RX1512 supports the following WAN (Wide Area Network) line modules:

NOTE

- *Only one T1/E1 WAN module may be used per router.*
- *The TC1, TC2 and TC4 WAN modules comply with Part 68 of the FCC rules and requirements adopted by ACTA. The product identifier is provided on a label on top of the modules. If requested, this information must be provided to the telephone company.*
- *The TC1, TC2 and TC4 WAN modules meet the Industry Canada's CS-03 Part II, Issue 9 technical specifications. The industry Canada registration number and model number is provided on a label on top of the modules.*
- *The WAN modules TC1, TC2 and TC4 use only RJ48C connectors.*

- *The modules have no user serviceable parts and equipment must only be repaired by authorized Siemens personnel only.*

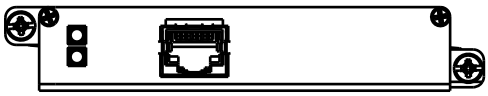

Figure 32: 1 × T1/E1 with RJ45 Ports (TC1)

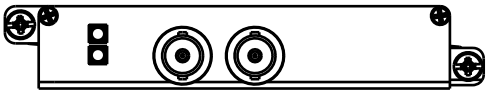

Figure 33: 1 × E1 with BNC Ports (E01)

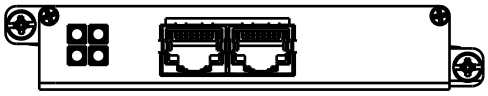

Figure 34: 2 × T1/E1 with RJ45 Ports (TC2)

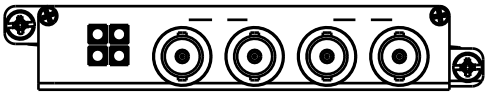

Figure 35: 2 × E1 with BNC Ports (E02)

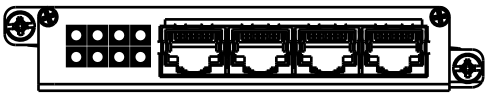

Figure 36: 4 × T1/E1 with RJ45 Ports (TC4)

The following is the pin-out for the BNC and RJ45 connectors:

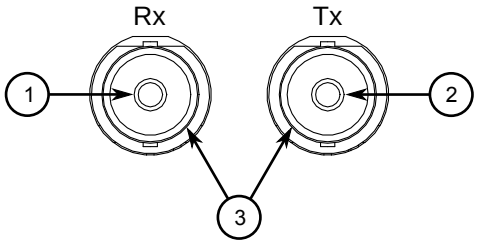

Figure 37: RJ45 T1/E1 Pin Configuration

1. RTIP **2.** TTIP **3.** Chassis

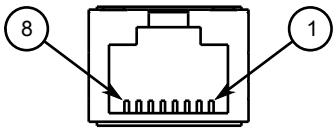

Figure 38: RJ45C T1/E1 Pin Configuration

Pin	Name	Description
1	RRING	Receive Negative
2	RTIP	Receive Positive
3	Reserved (Do Not Connect)	
4	TRING	Transmit Negative
5	TTIP	Transmit Positive
6	Reserved (Do Not Connect)	
7	Reserved (Do Not Connect)	

Pin	Name	Description
8	Reserved (Do Not Connect)	

Section 3.5

Serial Ports

The RX1512 supports RJ45 serial ports that may be used with a null modem (crossover) serial cable.

Modes

Each serial port can be run in RS232, RS485 or RS422 mode.

On power-up, all serial ports default to RS485 mode. Each port can be individually set to RS232, RS485 or RS422 mode through ROX II. For more information, refer to the *ROX II User Guide* for the RX1512.

LEDs

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

State	Description
Green	Activity detected
Off	No activity

Pin-Out

The following are the pin-outs for the RJ45 connectors:

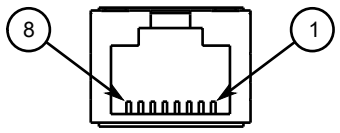

Figure 39: Serial RJ45 Port

Pin	RS232 Mode	RS485 Mode	RS422 Mode
1			RX- (Receive Negative)
2	Reserved (Do Not Connect)		
3[b]	Common (Isolated) Ground		
4[b]			
5	RX (Receive)		RX+ (Receive Negative)
6	TX (Transmit)	TX/RX+ (Transmit/ Receive Positive)[c]	TX+ (Transmit Positive)
7	Note[d]	TX/RX- (Transmit/ Receive Negative)[e]	TX- (Transmit Negative)
8	Note[d]	TX/RX- (Transmit/	TX- (Transmit Negative)

Pin	RS232 Mode	RS485 Mode	RS422 Mode
		Receive Negative)[e]	
Shield		Chassis Ground	

[b] *Pins 3 and 4 are connected together internally.*

[c] *15 kΩ pull-up resistor present on board.*

[d] *Pins 7 and 8 are connected together internally to simulate RTS-CTS hardware flow control for the user.*

[e] *In noisier environments, external pull-down resistors may be required for the negative terminal.*

Connecting to RS485 Devices

For information about how to connect devices configured to run in RS485 mode, refer to Section 3.10, “Connecting Multiple RS485 Devices”.

Specifications

For specifications on serial ports, refer to Section 4.3, “Copper Serial Port Specifications”.

Section 3.6

Cellular Modem Modules

The RX1512 supports the following cellular modem line modules for operation on GSM, EDGE, HSPA+, or CDMA networks:

DANGER!

Radio interference hazard – risk of death, serious personal injury or equipment damage. Do not operate the cellular modem in the following areas:

- *Areas where explosives are actively used*
- *In explosive atmospheres, such as refueling stations, fuel depots, chemical plants, underground mining operations, etc.*
- *Near medical or life support equipment or devices*
- *In any aircraft, whether in flight or on the ground (unless permitted by the aircraft operator)*

In such areas, the cellular modem must be turned off. Otherwise the cellular modem can transmit signals that may interfere with nearby equipment that is susceptible to radio interference.

WARNING!

Communication disruption hazard – risk of serious personal injury, equipment damage, or data loss. Wireless communications are susceptible to disruptions that may result in the delay, corruption or loss of data. While cellular disruptions are uncommon when using a Siemens cellular modem, avoid using the cellular modem in applications where a communication failure could result in damage to equipment or personal injury to persons in the area. Siemens accepts no responsibility for any damages that may result due to wireless disruptions.

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.

NOTE
If two or more antennas are to be installed, the antennas must be separated by a minimum distance of 20 cm (7.9 in).

IMPORTANT!
If the device is intended for use in a portable device, separate approval is required to satisfy the SAR requirements of FCC Part 2.1093 and IC RSS-102.

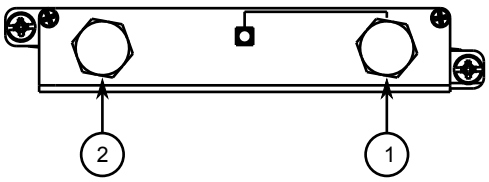

Figure 40: W11 and W21 Cellular Modems

1. Main Antenna SMA Connector **2.** Receive Diversity Antenna SMA Connector

Order Code	Description
W11	1 Port Cell Modem GSM,EDGE,HSPA+
W21	1 Port Cell Modem EVDO Rev.A Verizon Wireless

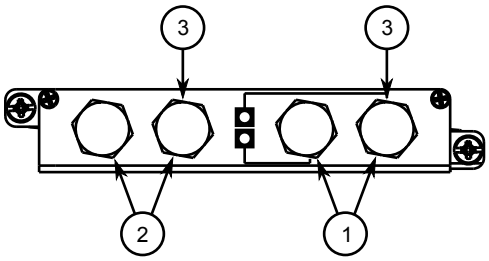

Figure 41: W12, W22 and W32 Cellular Modems

1. Main Antenna SMA Connector **2.** Receive Diversity Antenna SMA Connector **3.** Antenna for First/Primary Cell Modem

Order Code	Description
W12	2 Port Cell Modem GSM,EDGE,HSPA+
W22	2 Port Cell Modem EVDO Rev.A Verizon Wireless
W32	1 Port Cell Modem GSM,EDGE,HSPA+, 1 Port Cell Modem EVDO Rev.A Verizon Wireless

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

- Section 3.6.1, “Cellular Modem Installation Requirements”
- Section 3.6.2, “Diversity Requirements”
- Section 3.6.3, “Supported Frequency Bands”
- Section 3.6.4, “Installing SIM Cards for GSM, EDGE and HSPA+ Cellular Modems”

Section 3.6.1

Cellular Modem Installation Requirements

The cellular modem module is approved for modular use in mobile applications. The module, as part of the RUGGEDCOM RX1512, can be integrated into a final product without additional certification from the Federal Communications Commission (FCC) or Industry Canada (IC) if the application meets the following requirements:

NOTE
If this module is integrated into a portable device, separate approval related to the Specific Absorption Rate (SAR) requirements of FCC Part 2.1093 and IC RSS-102 is required.

- Persons in the area must be kept at least 20 cm (8 in) from the antenna at all times.
- The antenna gain, including cable loss, must not exceed the maximum rating specified in Section 3.6.3, "Supported Frequency Bands".
- The cellular modem and antenna must not be next to or operate in conjunction with another transmitter or antenna within a host device.
- A label must be affixed to the end product that indicates the FCC and IC IDs for the cellular modem.

Cellular Modem	FCC ID	IC ID
W11, W12	N7MC8705	2417C-MC8705
W21, W22	N7MC5728	2417C-MC5728
W32	N7MC8705 and N7MC5728	2417C-MC8705 and 2417C-MC5728

- The user documentation for the end product must clearly indicate the operating requirements and conditions that comply with current FCC and IC radio frequency exposure guidelines.
- The end product must comply with the unintentional emission testing requirements of FCC Part 15.

If the application does not meet these requirements, further certification is required.

Section 3.6.2

Diversity Requirements

Diversity, where two antennas exist within the same physical housing, is a method for improving radio signal strength. When two antennas are present, the following requirements must be met:

- Antenna isolation must be minimum 10 dB to prevent the receive antenna from picking up too much power from the transmit antenna.
- Performance characteristics of the transmit and receive antennas must be comparable.
- The performance of the receive antenna, as measured by forward link throughput, must be 0 to 3 dB better than a single antenna.

Section 3.6.3

Supported Frequency Bands

The following frequency bands are supported by the available cellular modem modules.

WARNING!
Electromagnetic 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)[f]
	Tx (MHz)	VSWR	Rx (MHz)	VSWR		
Band I WCDMA 2100	1920-1980	< 2.5:1	2110-2170	< 3.5:1	✓	4
Band II WCDMA 1900	1850-1910	< 2.5:1	1930-1990	< 2.5:1	✓	4
Band VIII WCDMA 900	880-915	< 2.5:1	925-960	< 3.5:1	✓	5
Band V WCDMA 850	824-849	< 2.5:1	869-894	< 3.5:1	✓	5
Band VI WCDMA 800	830-840	< 2.5:1	875-885	< 3.5:1	✓	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

[f] *Gain limits are reported on certification grants, for consideration against Radio Frequency (RF) exposure and Effective Radiated Power (ERP)/Effective Isotropic Radiated Power (EIRP) limits.*

Section 3.6.4

Installing SIM Cards for GSM, EDGE and HSPA+ Cellular Modems

To install a SIM card in a GSM, EDGE or HSPA+ cellular modem, do the following:

CAUTION!
Static electricity hazard – risk of damage to equipment. Make sure to take appropriate anti-static precautions before opening the cellular modem module.

NOTE
The RUGGEDCOM RX1512 only supports mini-SIM cards (2FF size format.

1. Remove the module from the chassis.
2. On the smooth side of the module, remove the four screws and separate the back of the module from the module chassis.

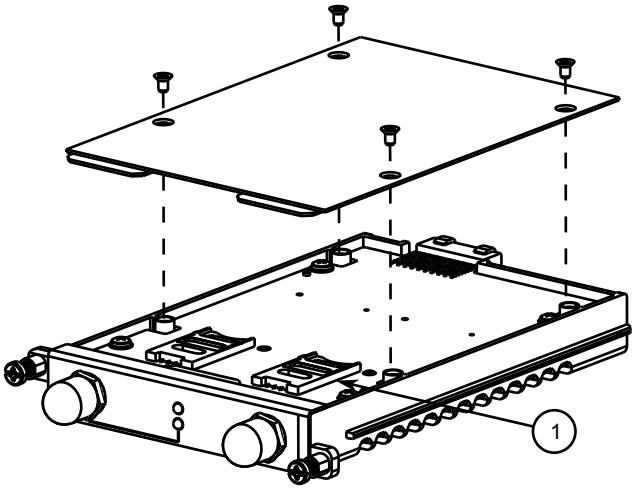

Figure 42: W11, W21 Cellular Modem

1. SIM Card Cage 1

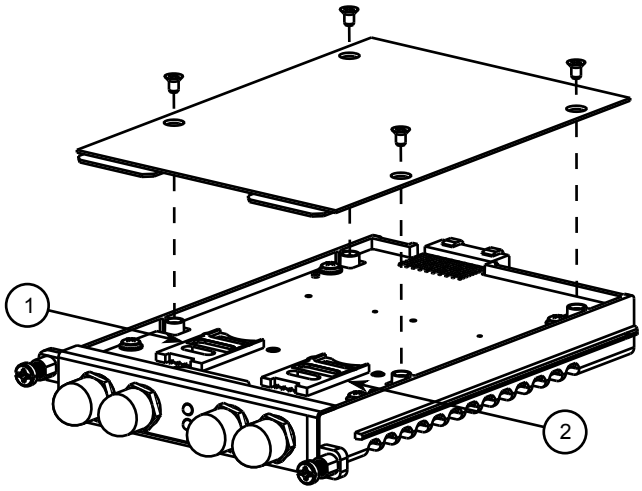

Figure 43: W12, W22, W32 Cellular Modem

1. SIM Card Cage 1 **2.** SIM Card Cage 2

3. Open SIM card cage 1 by sliding the silver catch towards the antenna connectors and flip the cage up.
4. Insert a mini-SIM card into the cage.
5. Close SIM card cage 1 by flipping the cage down and slide the silver catch away from the antenna connectors.
6. For W12, W22 and W32 cellular modems, repeat Step 3 to Step 5 install a mini-SIM card in SIM card cage 2.
7. Install the back of the module and secure it to the module chassis with the four screws removed previously.
8. Install the module. For more information, refer to Section 3.9.1, “Installing a Module”.

Section 3.7

DDS (Digital Data Services) Modules

The RX1512 can be equipped with a DDS port line module that supports 56 kbps (Master/Slave) and 64 kbps (Slave) line rates.

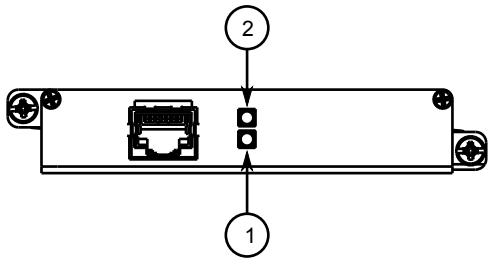

Figure 44: 1 × DDS with RJ-48S Ports (D02)

1. Rx LED **2.** Tx LED

Standards and Operating Modes

The module is compatible with the following standards:

- AT&T PUB 62310 (Standard DDS)
- BELLCORE TA-TSY-000077
- BELLCORE TR-TSY-000458
- ANSI T1.410

It also supports the following operating modes, which are configurable via the RUGGEDCOM ROX II user interface:

Operating Mode	Line Rate
DDS-PRI	56 kbps
CC-64K	72 kbps

LEDs

Each RJ-48S port features a **RX** and **TX** LED that indicates the state of the port.

LED	LED Color	Status
Rx	Green	Connection established
Tx		
Rx	Yellow	The interface is receiving an OOF (Out of Frame) alarm.
Tx		The interface is in loopback mode.
Rx	Red	The interface is receiving an ALOS (Alarm Loss of Signal) or Red alarm (e.g. corruption or loss of signal, connectivity loss, or no knowledge of connectivity).

LED	LED Color	Status
Tx		The interface is receiving or transmitting an RAI (Remote Alarm Indication) or AIS (Alarm Indication Signal) alarm.
Rx	Off	The interface is disabled.
Tx		

Pin-Out

The following is the pin-out for the DDS RJ-48S ports:

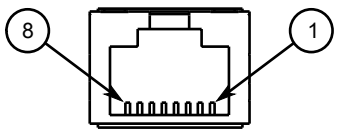

Figure 45: DDS RJ-48S Pin

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 (Ring)
8	R	Receive data from network (Tip)

Section 3.8

RUGGEDCOM APE Module

The RX1512 supports various versions of the RUGGEDCOM APE (Application Processing Engine) module. The APE is an x86-based computer design that can host a variety of x86-based operating systems. It also features Gigabit Ethernet (GbE) ports, USB ports and a DVI-D video port. For more information about RX1512 APE, including installation and setup instructions, refer to the *RUGGEDCOM APE User Guide*.

CAUTION!
Electrical hazard – risk of power failure. Installing more APE modules than allowed can lead to power fluctuations and irregular shut downs. Do not install more than one APE module on the device.

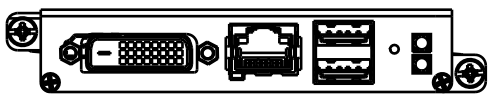

Figure 46: RUGGEDCOM APE Module

For specifications, refer to Section 4.8, “RUGGEDCOM APE Specifications”.

Section 3.9

Installing/Removing Modules

The following sections describe how to install and remove modules:

- Section 3.9.1, “Installing a Module”
- Section 3.9.2, “Removing a Module”

Section 3.9.1

Installing a Module

Upon installing a new module in the device, all the features associated to the module are available in the operating system. For more information, refer to the *ROX II User Guide* for the RX1512.

To install a module, do the following:

1. Make sure power to the device has been disconnected and wait approximately two minutes for any remaining energy to dissipate.
2. If the device is installed in a rack, remove it from the rack.
3. Remove the current module from the slot. For more information, refer to Section 3.9.2, “Removing a Module”.
4. Insert the new module into the slot.

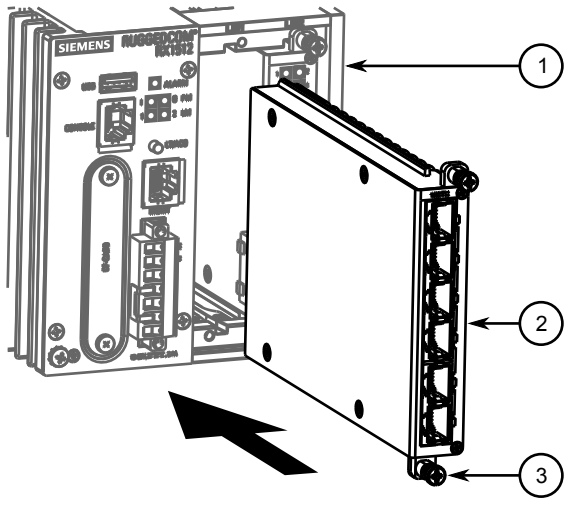

Figure 47: Installing a Module

1. Module **2.** Chassis **3.** Screw

5. Tighten the screws to secure the module.
6. If necessary, install the device in the rack.
7. Connect power to the device.

Section 3.9.2

Removing a Module

Once a module is removed, all the features associated with the module are hidden or disabled in the operating system.

To remove a module, do the following:

1. Make sure power to the device has been disconnected and wait approximately two minutes for any remaining energy to dissipate.
2. If the device is installed in a rack, remove it from the rack.
3. Loosen the screws that secure the module.
4. Pull the module from the chassis to disconnect it.

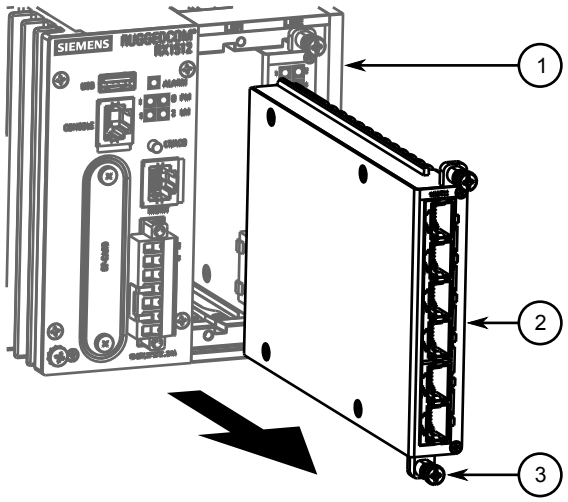

Figure 48: Installing a Module

1. Module **2.** Chassis **3.** Screw

5. Install a new module or a blank module (to prevent the ingress of dust and dirt). For more information, refer to Section 3.9.2, “Removing a Module”.
6. If necessary, install the device in the rack.
7. Connect power to the device.

Section 3.10

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.

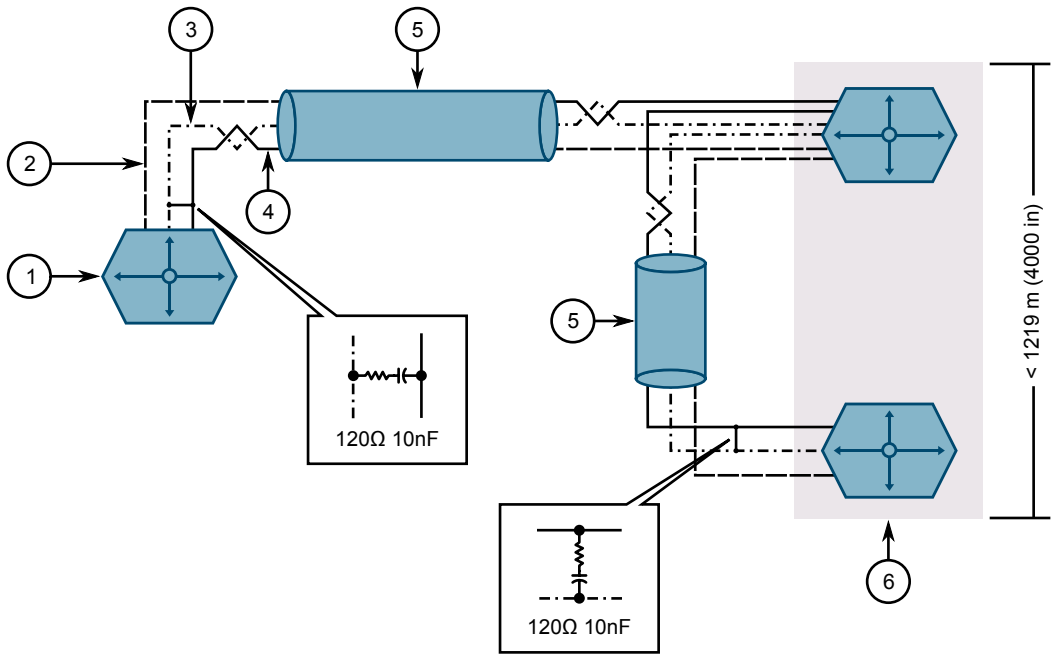

Figure 49: Recommended RS485 Wiring

1. RX1512 Device **2.** Common (Isolated Ground) **3.** Negative **4.** Positive **5.** Shield to Earth (Connected At a Single Point) **6.** RS485 Devices (32 Total)

NOTE

A 15 kΩ pull-up resistor is present on board for the positive terminal.

In noisy environments, additional pull-down resistors may be required for the negative terminal.

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	Maximum Power Consumption[a]	Maximum Cable Length[b]	Insulation
	Min	Max				
Internal	11 VDC	72 VDC	6.3 A	26.4 W	—	

[a] *Power consumption varies based on the device configuration.*

[b] *Based on #16 AWG wiring.*

Section 4.2

Failsafe Relay Specifications

Maximum Switching Voltage	Rated Switching Current	Isolation
30 VDC	2 A, 60 W	1500 V_{rms} for 1 minute
125 VDC	0.24 A, 30 W	
125 VAC	0.5 A, 62.5 W	
220 VDC	0.24 A, 60 W	
250 VAC	0.25 A, 62.5 W	

Section 4.3
Copper Serial Port Specifications

Baud Rate	Connector	Isolation
1200 to 230400 kbps	RJ45	2500 VDC for 1 minute

Section 4.4
Copper Ethernet Port Specifications

The following details the specifications for copper Ethernet ports that can be ordered with the RX1512.

Speed[c]	Connector	Mode	Duplex[c]	Cable Type[d]	Wiring Standard[e]	Maximum Distance	Isolation[f]
10/100/1000TX	RJ45	—	FDX/ HDX	> CAT-5	TIA/EIA T568A/B	100 m (328 ft)	1.5 kV
10/100/1000TX	8-Pin A-Coded M12	—	FDX/ HDX	> CAT-5	TIA/EIA T568A/B	100 m (328 ft)	1.5 kV
10/100/1000TX	8-Pin A-Coded M12	Controlled Bypass	FDX/ HDX	> CAT-5	TIA/EIA T568A/B	100 m (328 ft)	1.5 kV
10/100/1000TX	8-Pin X-Coded M12	—	FDX/ HDX	> CAT-5	TIA/EIA T568A/B	100 m (328 ft)	1.5 kV
10/100/1000TX	8-Pin X-Coded M12	Controlled Bypass	FDX/ HDX	> CAT-5	TIA/EIA T568A/B	100 m (328 ft)	1.5 kV
10/100TX	RJ45	—	FDX/ HDX	> CAT-5	TIA/EIA T568A/B	100 m (328 ft)	1.5 kV
10/100TX	8-Pin A-Coded M12	—	FDX/ HDX	> CAT-5	TIA/EIA T568A/B	100 m (328 ft)	1.5 kV
10/100TX	8-Pin A-Coded M12	Controlled Bypass	FDX/ HDX	> CAT-5	TIA/EIA T568A/B	100 m (328 ft)	1.5 kV
10/100TX	4-Pin A-Coded M12	—	FDX/ HDX	> CAT-5	TIA/EIA T568A/B	100 m (328 ft)	1.5 kV
10/100TX	4-Pin A-Coded M12	Controlled Bypass	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 4.5
Fiber Optic Ethernet Port Specifications

The following sections detail fiber optic specifications for ports that can be equipped on the RX1512. 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 ROX II 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 *ROX II User Guide* for the RX1512.

Section 4.5.1

10Base-FL/100Base-SX Ethernet Optical Specifications

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	820	-16	-9	-34	-11.2	2	18
		50/125		-19.8	-12.8				14.2

Section 4.5.2

Fast Ethernet (100 Mbps) Optical Specifications

Fixed Fast Ethernet Transceivers

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
		50/125		-22.5					8.5
MM	MTRJ	62.5/125	1300	-19	-14	-31	-14	2	12
		50/125		-22.5					8.5
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	LC	9/125	1300	-15	-8	-34	-7	20	19
SM	SC	9/125	1300	-5	0	-34	-3	50	29
SM	LC	9/125	1300	-5	0	-35	3	50	30

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
SM	LC	9/125	1300	0	5	-37	0	90	37
MM	MTRJ	62.5/125	1300	-19	-14	-31	-14	2	12
	LC	50/125		-22.5					8.5
MM	MTRJ	62.5/125	1300	-19	-14	-31	-14	2	12
	LC	50/125		-22.5					8.5

» SFP Fast Ethernet Transceivers

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	LC	62.5/125	1310	-20	-14	-31	-14	2	11
		50/125		-23.5					7.5
MM	LC	62.5/125	1310	-20	-14	-31	-14	2	11
		50/125		-23.5					7.5
SM	LC	9/125	1300	-15	-8	-31	-8	15	16
SM	LC	9/125	1300	-15	-8	-31	-8	15	16
SM	LC	9/125	1300	-5	0	-34	0	40	29
SM	LC	9/125	1300	-5	0	-34	0	40	29
SM	LC	9/125	1550	-5	0	-34	-10	80	29
SM	LC	9/125	1550	-5	0	-34	-10	80	29

Section 4.5.3

Gigabit Ethernet (1 Gbps) Optical Specifications

NOTE

- *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.*
- *All optical power numbers are listed as dBm averages.*
- *F51 transceivers are rated for -40 to 85 °C (-40 to 185 °F).*

Fixed Gigabit Transceivers

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	LC	50/125	850	-9	-2.5	-20	0	0.5	11
SM	SC	9/125	1310	-10	-3	-20	-3	10	10
SM	LC	9/125	1310	-9.5	-3	-21	-3	10	11.5
SM	SC	9/125	1310	-5	0	-20	-3	25	15
SM	LC	9/125	1310	-7	-3	-24	-3	25	17

SFP Gigabit Transceivers

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	LC	50/125	850	-9	-2.5	-20	0	0.5	11
		62.5/125						0.3	
SM	LC	9/125	1310	-9.5	-3	-19	-3	10	9.5
SM	LC	9/125	1310	-7	-3	-23	-3	25	16
SM	LC	9/125	1550	0	5	-23	-3	70	23

Section 4.6

Cellular Modem Specifications

Conducted Tx (Transmit) Power Tolerances for W11, W12 and W32 (Primary Radio) Cellular Modems

System/Operating Band	Frequency Band (MHz)	Conducted Tx Power (dBm)	Comment
GSM-850 and GSM-900[g]	850/900	+32 ± 1	GMSK mode, connectorized (class 4)
		+27 ± 1	8PSK mode, connectorized (class E2)
DCS-1800 and PCS-1900[g]	1800/1900	+29 ± 1	GMSK mode, connectorized (class 1)
		+26 ± 1	8PSK mode, connectorized (class E2)
Band I	2100	+23 ± 1	AMR 12.2 kbps, connectorized (class 3)
Band II, V, VI and VIII	800, 850, 900 and 1900		

[g] *Circuit-Shared*

Typical Radio Frequency (RF) for W21, W22 and W32 (Secondary Radio) Cellular Modems

System/Operating Band	Frequency Band (MHz)		Conducted Tx Power (dBm)
	Transmit (Tx)	Receive (Rx)	
PCS	1851 to 1910	1930 to 1990	23 to 25
Cellular	824 to 849	869 to 894	

Operating Temperature

Module	Operating Temperature	Compliance
W11, W12, W32 (First Radio)	-25 to 60 °C (-13 to 140 °F)	Full Radio Frequency (RF) compliance
	60 to 75 °C (140 to 167 °F)	Reduced Radio Frequency (RF) performance
W21, W22, W32 (Second Radio)	-30 to 60 °C (-22 to 140 °F)	Full Radio Frequency (RF) compliance
	60 to 75 °C (140 to 167 °F)	Reduced Radio Frequency (RF) performance

Section 4.7

Operating Environment

NOTE
The ambient operating temperature is reduced for devices equipped with a cellular modem. For more information, refer to Section 4.6, "Cellular Modem Specifications".

Parameter	Range	Comments
Ambient Operating Temperature	-40 to 85 °C (-40 to 185 °F)[h]	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)	

[h] *Maximum ambient operating temperature is 70 °C (158 °F) when the device is installed along with Underwriter Laboratories (UL) listed devices.*

Section 4.8

RUGGEDCOM APE Specifications

Feature	APE1402	APE1402W7	APE1404	APE1404W7	APE1404CKP
Processor	Intel Atom E660 1.3 GHz, 512 KB L2 Cache		Intel Atom E660T 1.3 GHz, 512 KB L2 Cache		
RAM	2 GB DDR2, 800 MHz, 32-bit				
Disk	8 GB SATA, solid state		16 GB SATA, solid state		

Feature	APE1402	APE1402W7	APE1404	APE1404W7	APE1404CKP
Networking	Realtek RTL8111, RJ45 Gigabit Ethernet interface				
USB	2 x USB 2.0, maximum combined USB device power consumption 500 mA at 5 V				
Video	Intel 4108 Grpahics Processor, DVI-D				
LED Indications	Power and Disk				
Controls	Momentary contact reset button				
Temperature Range	-40 to 70 °C (-40 to 158 °F)				
Power Requirements	12 W with no USB load, 14.5 W with full USB load				
Software Platform	Debian Linux®	Windows® Embedded Standard 7	Debian Linux®	Windows® Embedded Standard 7	Check Point GAiA™ OS

Section 4.9

Mechanical Specifications

Parameter	Value
Dimensions	Refer to Chapter 5, *Dimension Drawings*
Weight	Approximately 2.3 kg (5 lb)
Ingress Protection	IP40
Enclosure	Aluminum

5 Dimension Drawings

NOTE
All dimensions are in millimeters, unless otherwise stated.

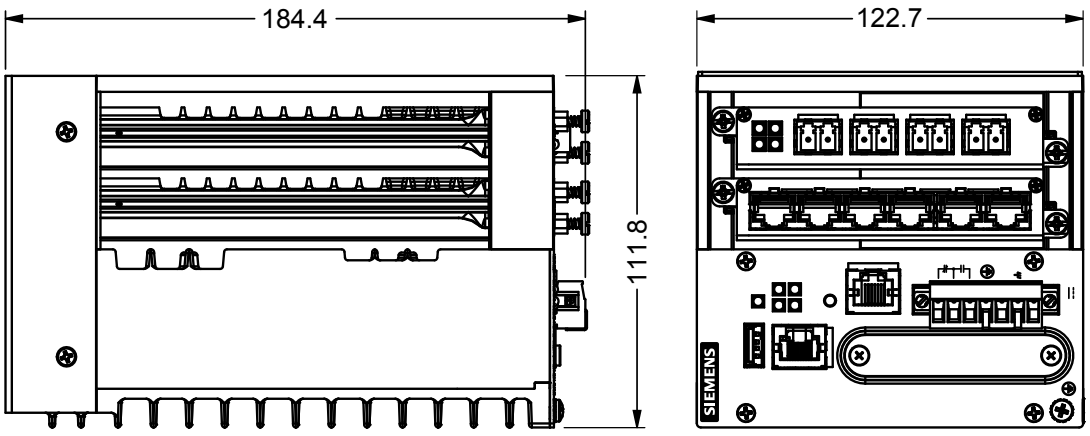

Figure 50: Overall Dimensions

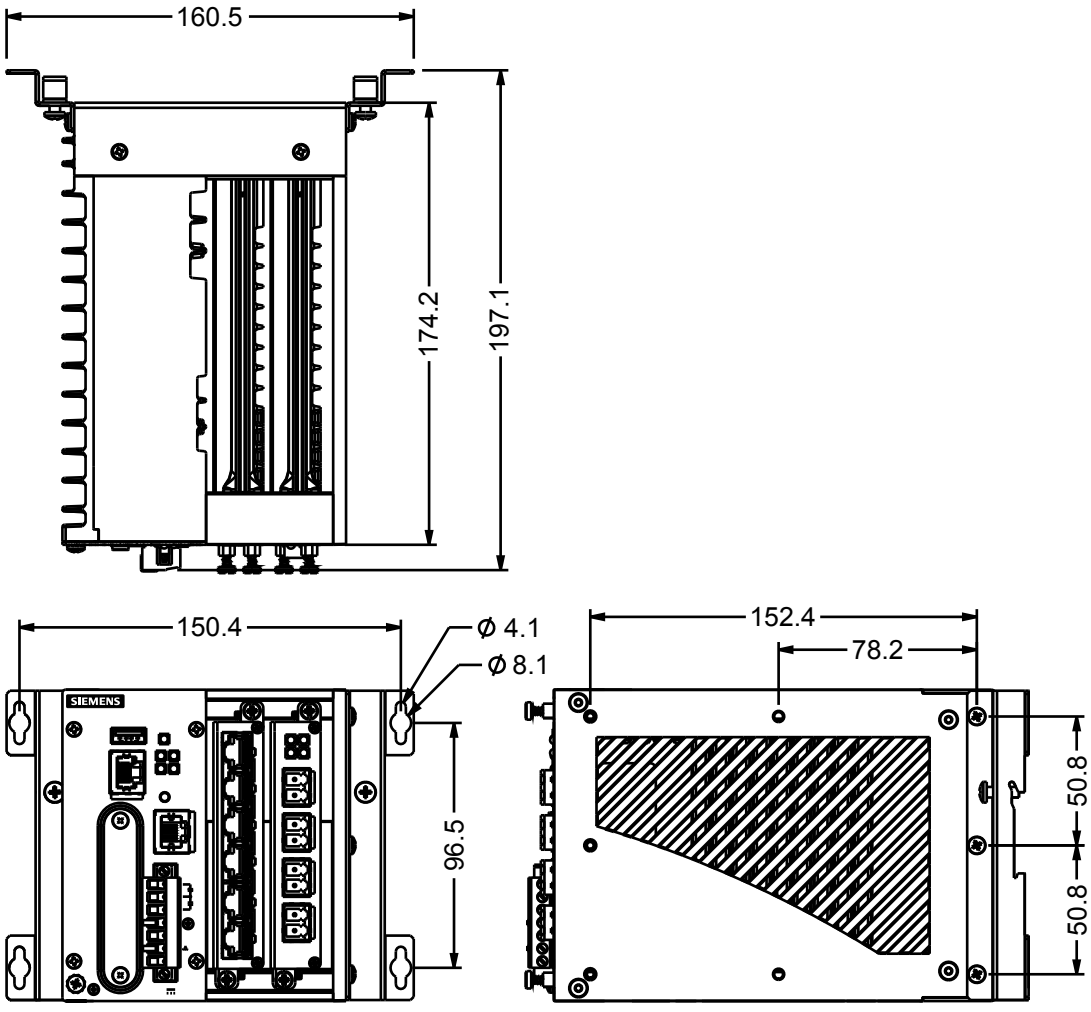

Figure 51: Panel and Din Rail Mount Dimensions

6 Certification

The RUGGEDCOM RX1512 device has been thoroughly tested to guarantee its conformance with recognized standards and has received approval from recognized regulatory agencies.

Section 6.1

Standards Compliance

The RUGGEDCOM RX1512 complies with the following standards:

- **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.
- **Industry Canada Compliance**
  CAN ICES-3 (A) / NMB-3 (A)
- **Other**
  - IEEE 1613 (Electric Utility Substations)
  - IEC 61850-3 (Electric Utility Substations)
  - IEC 61000-6-2 (Generic Industrial)

Section 6.2

Agency Approvals

Agency	Standards	Comments
TUV	UL 60950-1 CAN/CSA-C22.2 No. 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
	FCC Part 15, Subpart B	Cellular LM Models RX1500PN-W11-XX RX1500PN-W12-XX RX1500PN-W32-XX

Agency	Standards	Comments
		FCC ID for W11 and W12: N7NMC8705 FCC ID for W32: N7NMC8705/N7N-MC5728
FDA/CDRH	21 CFR Chapter I, Sub-chapter J	Laser Eye Safety
ISO	ISO9001:2008	Designed and manufactured using an ISO9001: 2008 certified quality program
ACTA	FCC Part 68	TC1, TC2 and TC4 line modules
Industry Canada	IC CS-03 Part II, Issue 9	TC1, TC2 and TC4 line modules
		Cellular LM Models RX1500PN-W11-XX RX1500PN-W12-XX RX1500PN-W32-XX IC ID for W11 and W12: 2417C-MC8705 IC ID for W32: 2417C-MC8705/2417C-MC5728
		Cellco Partnership d/b/a Verizon Wireless Open Development Certification Agreement MA-004198-2012 Carrier Certification for Cellular LM Models RX1500PN-W21-XX RX1500PN-W22-XX RX1500PN-W32-XX
		AT&T Cellular LM Models RX1500PN-W11-XX RX1500PN-W12-XX RX1500PN-W32-XX FCC ID for W11 and W12: N7NMC8705 FCC ID for W32: N7NMC8705/N7N-MC5728 IC ID for W11 and W12: 2417C-MC8705 IC ID for W32: 2417C-MC8705/2417C-MC5728

Section 6.3

EMC and Environmental Type Tests

The RX1512 has passed the following EMC 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	
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	
		DC Power Ports	± 4 kV	4
		Earth ground ports		

Test	Description		Test Levels	Severity Levels
IEC 61000-4-5	Surge	Signal ports	± 2 kV Line-to-Ground, ± 2 kV Line-to-Line	4
		DC Power Ports	± 2 kV Line-to-Ground, ± 1 kV Line-to-Line	3
IEC 61000-4-6	Induced (Conducted) RFI	Signal ports	10 V	3
		DC Power Ports		
		Earth ground ports		
IEC 61000-4-8	Magnetic Field	Enclosure Ports	40 A/m, continuous, 1000 A/m for 1 s	Note[a]
			1000 A/m for 1 s	5
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	
IEC 61000-4-12	Damped Oscillatory	Signal ports	2.5 kV common, 1 kV differential mode @1 MHz	3
		DC Power Ports		
IEC 61000-4-16	Mains Frequency Voltage	Signal ports	30 V Continuous, 300 V for 1 s	4
		DC Power Ports		
IEC 61000-4-17	Ripple on DC Power Supply	DC Power Ports	10%	3
IEC 60255-5	Dielectric Strength	Signal ports	2 kV (Failsafe Relay output)	
		DC Power Ports	2 kV	
	HV Impulse	Signal ports	5 kV (Failsafe Relay output)	
		DC Power Ports	5 kV	

[a] *Siemens-specified severity levels*

IEEE 1613 EMC Immunity Type Tests

NOTE
The RX1512 meets Class 2 requirements for an all-fiber configuration and Class 1 requirements for copper ports.

Description		Test Levels
HV Impulse	Signal ports	5 kV (Failsafe Relay Output)
	DC Power Ports	5 kV
Dielectric Strength	Signal ports	2 kV
	DC Power Ports	2 kV
Fast Transient	Signal ports	± 4 kV @ 2.5 kHz
	DC Power Ports	± 4 kV
	Earth ground ports	
Oscillatory	Signal ports	2.5 kV common mode @1MHz

Description		Test Levels
	DC Power Ports	2.5 kV common, 1 kV differential mode @ 1 MHz
Radiated RFI	Enclosure ports	35 V/m
ESD	Enclosure Contact	±2 kV, ±4 kV, ± 8 kV
	Enclosure Air	±4 kV, ±8 kV, ±15 kV

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	
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
	Bump		10 g @ 16 ms	Class 1
IEC 60255-21-3	Seismic		Method A	Level 2