SIEMENS

RUGGEDCOM RMC8388

Installation Guide

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Table of Contents

Preface

This guide describes the RUGGEDCOM RUGGEDCOM RMC8388. 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:

- *ROS User Guide for the RUGGEDCOM RMC8388*

Accessing Documentation

The latest user documentation for RUGGEDCOM RMC8388 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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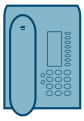

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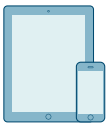

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- Access Siemens' extensive library of support documentation, including FAQs and manuals
- Submit SRs or check on the status of an existing SR
- Contact a local Siemens representative from Sales, Technical Support, Training, etc.
- Ask questions or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

1 Introduction

The RUGGEDCOM RMC8388 is a rugged, small form factor time converter designed to operate in electrically harsh environments with widely varying climatic and environmental conditions such as those found in utility substations. Designed and verified to withstand extreme temperatures, vibrations and shock, the RUGGEDCOM RMC8388 offers exceptional reliability.

With the capability to convert PTP time input to IRIG-B, the RUGGEDCOM RMC8388 allows migration to the newer PTP technology while still supporting working equipment that require IRIG-B time input. This allows utilities to converge timing and data planes onto their Ethernet infrastructure while saving cabling and maintenance costs.

The primary benefits offered by the RUGGEDCOM RMC8388 include:

- **Time Conversion**
  Provide or receive IRIG-B time signals to be converted from or to PTP (IEEE 1588)
- **Form Factor**
  Space saving design allows easy integration into existing equipment cabinets
- **Migration Path**
  Allows migration to newer technology and still support existing equipment with no performance degradation
- **Rugged Design**
  Withstands harsh environments allowing installation in almost any environment

The following sections provide more information about the RUGGEDCOM RMC8388:

- Section 1.1, “Feature Highlights”
- Section 1.2, “Description”

Section 1.1

Feature Highlights

Rugged Rated for Reliability in Harsh Environments

- Immunity to EMI and heavy electrical surges
- Zero-Packet-Loss Technology
- Meets IEEE 1613 Class 2 (electric utility substations)
- Exceeds IEC 61850-3 (electric utility substations)
- Exceeds IEC 61000-6-2 (generic industrial)
- -40° C to 85° C operating temperature (fanless)
- Conformal coated printed circuit boards (optional)

Extreme Flexibility

- Support for a fiber or copper Ethernet port
- Galvanized Steel enclosure
- [Optional] Supports Siemens FastConnect™ RJ-45 cabling system

Cyber Security

- Multilevel user passwords
- Secure File Transfer Protocol (SFTP) using Secure Shell (SSH)
- Web-based management using Secure Sockets Layer (SSL)
- Remote Authentication Dial In User Service (RADIUS) authentication service for device management
- 1024-bit RSA encryption for key management and key exchange

Section 1.2

Description

The RUGGEDCOM RMC8388 features various ports, controls and indicator LEDs for connecting, configuring and troubleshooting the device. The final device configuration is determined during the ordering process. The following describes the major options available.

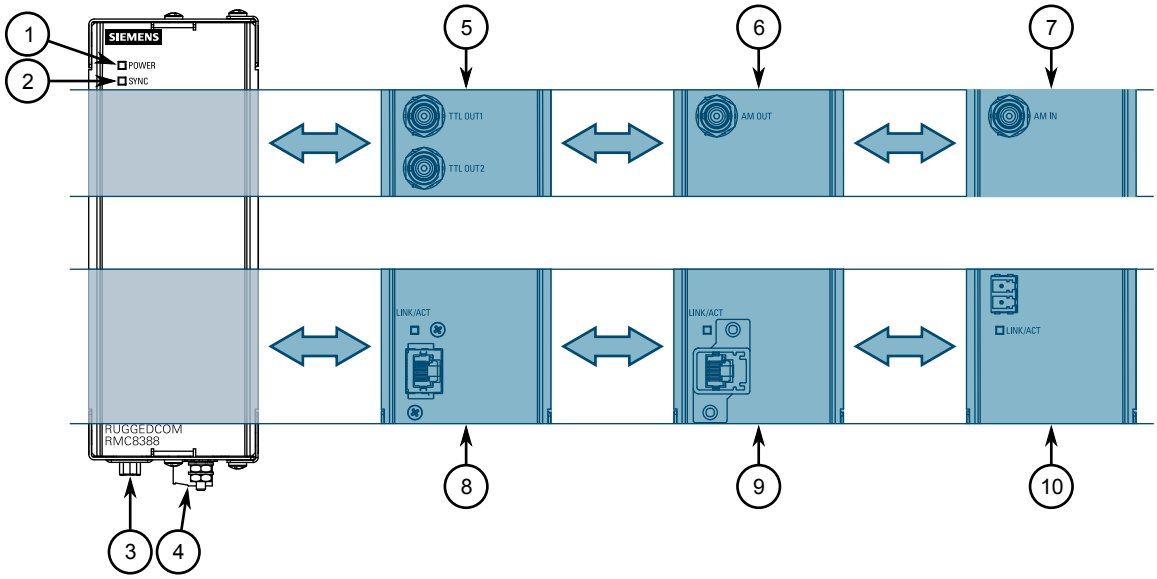

Figure 1: RUGGEDCOM RMC8388

1. POWER LED **2.** SYNC LED **3.** RS-232 Console Port **4.** Power Supply Terminal **5.** BNC Ports – TTL OUT1/2 **6.** BNC Port – AM OUT **7.** BNC Port – AM IN **8.** Copper Ethernet Port with LINK/ACT LED **9.** Copper FastConnect Ethernet Port with LINK/ACT LED **10.** Fiber Optic Ethernet Port with LINK/ACT LED

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

State	Description
Green	Device is ready
Red	Device is booting up
Off	No power

- **SYNC LED** – Indicates the status of the supplied timing signal.

State	Description
Green	Signal locked
Amber/Yellow	Holdover
Red	Error
Off	No signal detected

- **LINK/ACT LED** – Indicates the state of the copper or fiber optic Ethernet port.

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

- **RS232 Serial Console Port** – 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 2.4, “Connecting to the Device”.
- **Power Supply Terminal** – A pluggable terminal. For more information, refer to:
  - Section 2.3, “Connecting Power”
  - Section 4.1, “Power Supply Specifications”
- **BNC Port(s)** – Transmits/receives timing signals from one protocol to another. For more information about the individual BNC ports, refer to Section 3.1, “BNC Ports”.
- **Fiber Optic or Copper Ethernet Port** – Receives and transmits IEEE 1588 v2 messages, as well as provides remote Web access to the RUGGEDCOM ROS operating system. For more information, refer to:
  - Section 2.4, “Connecting to the Device”
  - Section 3.3, “Copper Ethernet Port (If Equipped)”
  - Section 3.2, “Fiber Optic Ethernet Port (If Equipped)”

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.

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.

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.*

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

Required Tools and Materials

The following tools and materials are required to install the RUGGEDCOM RMC8388:

Tools/Materials	Purpose
AC or DC power cord (16 AWG)	For connecting power to the device.
Shielded coaxial cables	For connecting the device to the network.
Flathead screwdriver	For mounting the device to a DIN rail.

Tools/Materials	Purpose
Phillips screwdriver	For mounting the device to a panel.
4 x #6-32 screws	For mounting the device to a panel.
Braided or equivalent ground wire	For grounding the device.

Section 2.2
Mounting the Device

The RUGGEDCOM RMC8388 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 2.2.1, “Mounting the Device on a DIN Rail”
- Section 2.2.2, “Mounting the Device to a Panel”

Section 2.2.1
Mounting the Device on a DIN Rail

For DIN rail installations, the RUGGEDCOM RMC8388 can be equipped with a DIN rail bracket pre-installed on the back of the chassis. The bracket allows the device to be slid onto a standard 35 mm (1.4 in) DIN rail.

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

1. Align the slot in the bracket with the DIN rail.

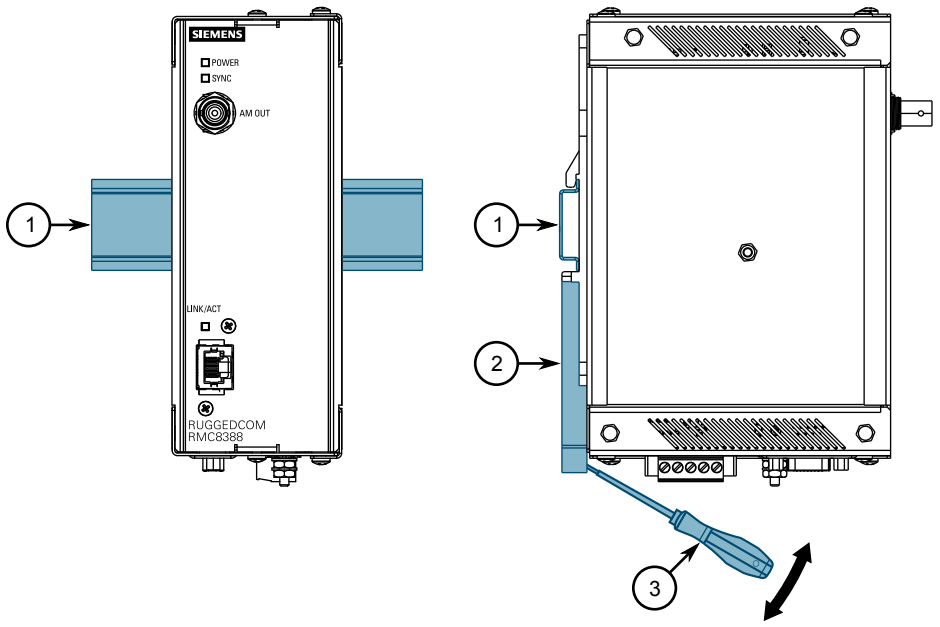

Figure 2: DIN Rail Mounting

1. DIN Rail **2.** DIN Rail Bracket **3.** Flathead Screwdriver

2. Using a flathead screwdriver, pull the release on the bracket down and slide the device onto the DIN rail. Push the release up to lock the device into position.

Section 2.2.2

Mounting the Device to a Panel

For panel installations, the RUGGEDCOM RMC8388 can be equipped with panel adapters that allow the device to be attached to a panel using screws.

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

1. Loosen the screws for the panel adapters located at the top and bottom of the device.

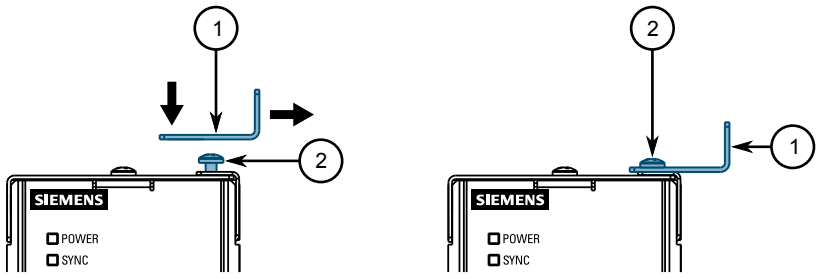

Figure 3: Installing the Panel Adapters

1. Panel Adapter **2.** Screw

2. For both adapters, align the slots with the screws and then slide the adapters onto the device.
3. Tighten the screws to secure the adapters.
4. Place the device against the panel and align the adapters with the mounting holes.

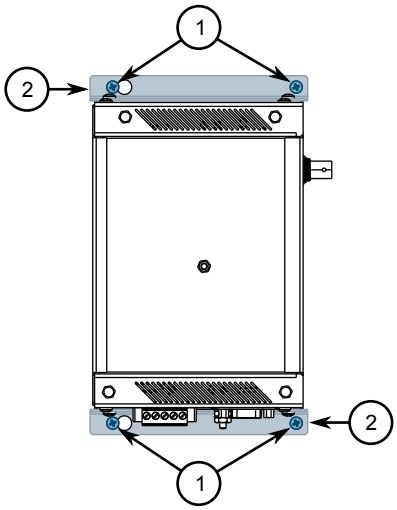

Figure 4: Panel Mounting

1. Screw **2.** Panel Adapter

5. Using two #6-32 screws for each adapter, secure the device to the panel.

Section 2.3

Connecting Power

The RUGGEDCOM RMC8388 supports a single integrated high AC/DC power supply, a 48 V low DC power supply, and a 24 V low DC power supply.

IMPORTANT!

Before installing the device, note the following:

- *An appropriately rated AC or DC circuit breaker must be installed.*
- *Use only #16 gage copper wiring when connecting terminal blocks.*
- *Equipment must be installed according to applicable local wiring codes and standards.*
- *All line-to-ground transient energy is shunted to the Surge Ground terminal. In cases where users require the inputs to be isolated from ground, remove the ground braid between Surge and Chassis Ground. Note that all line-to-ground transient protection circuitry will be disabled.*

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

- Section 2.3.1, “Connecting High AC/DC Power”
- Section 2.3.2, “Connecting Low DC Power”

Section 2.3.1
Connecting High AC/DC Power

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

CAUTION!
Electrical hazard – risk of damage to equipment. 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. Secure a European-style terminal block (or Euroblock) to the terminal.
2. Connect the positive wire from the power source to the positive/live (+/L) terminal on the terminal block.

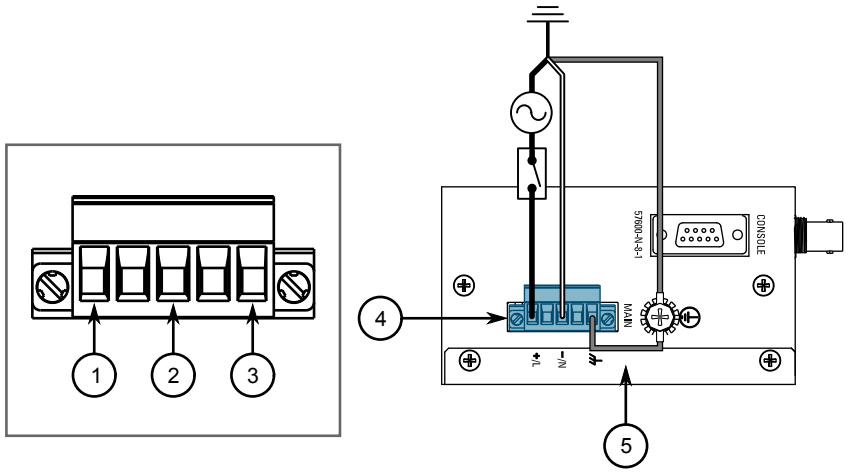

Figure 5: Terminal Block Wiring

1. Positive/Live (+/L) Terminal **2.** Negative/Neutral (-/N) Terminal **3.** Surge Ground Terminal **4.** Power Supply Terminal **5.** Braided Ground Cable

3. Connect the negative wire from the power source to the negative/neutral (-/N) terminal on the terminal block.
4. 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.
5. Connect the ground terminal on the power source to the chassis ground terminal on the device.

Section 2.3.2
Connecting Low DC Power

The RUGGEDCOM RMC8388 supports a single low DC power supply with dual power supply inputs. The use of both power supply inputs is recommended to provide input power redundancy.

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

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

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

1. Secure a European-style terminal block (or Euroblock) to the terminal.
2. Connect the positive wire from the power source to the positive terminal on the terminal block.

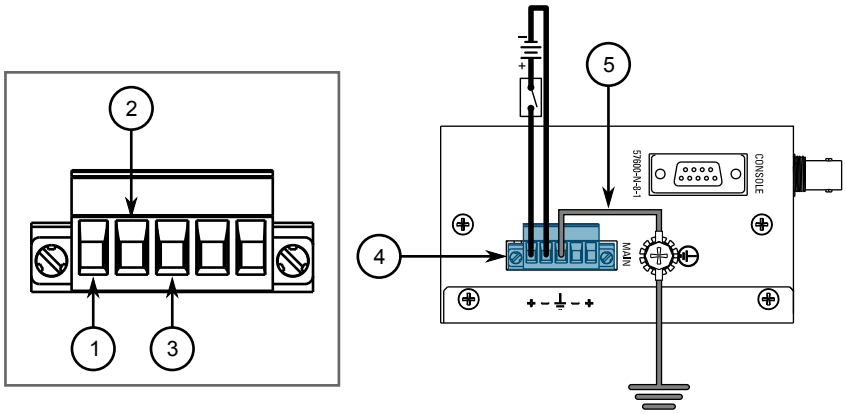

Figure 6: Terminal Block Wiring – Single DC Power Supply Input

1. Positive Terminal **2.** Negative Terminal **3.** Surge Ground Terminal **4.** Power Supply Terminal **5.** Braided Ground Cable

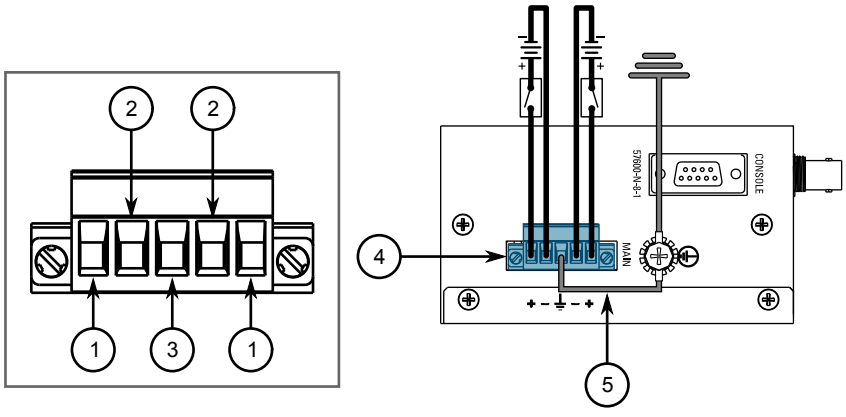

Figure 7: Terminal Block Wiring – Dual Redundant DC Power Supply Inputs

1. Positive Terminal **2.** Negative Terminal **3.** Surge Ground Terminal **4.** Power Supply Terminal **5.** Braided Ground Cable

3. Connect the negative wire from the power source to the negative terminal on the terminal block.

4. 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.
5. Connect the ground terminal on the power source to the chassis ground terminal on the device.

Section 2.4

Connecting to the Device

The following describes the various methods for accessing the ROS console and Web interfaces on the device. For more detailed instructions, refer to the *ROS User Guide* for the RUGGEDCOM RMC8388.

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 RS-232 DCE (Data Communication Equipment) on a female DB9 connector. The following is the pin-out for the port:

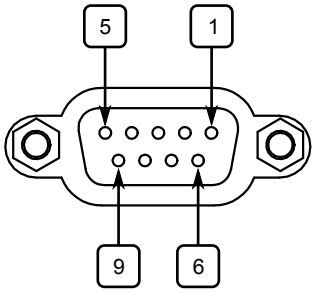

Figure 8: Serial DB9 Console Port

Pin	Name
1[a]	Reserved (Do Not Connect)
2	Output Signal
3	Input Signal
4[a]	Reserved (Do Not Connect)
5	Ground
6[a]	Reserved (Do Not Connect)
7[a]	Reserved (Do Not Connect)
8	Reserved (Do Not Connect)
9	Reserved (Do Not Connect)

[a] *Connected internally.*

Communication Ports

Connect any of the available Ethernet ports on the device to a management switch and access the RUGGEDCOM ROS console and Web interfaces via the device's IP address. The factory default IP address for the RUGGEDCOM RMC8388 is https://192.168.0.1.

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

3 Communication Ports

The RUGGEDCOM RMC8388 can be equipped with various types of communication ports to enhance its abilities and performance.

The following sections describe the available ports:

- Section 3.1, “BNC Ports”
- Section 3.2, “Fiber Optic Ethernet Port (If Equipped)”
- Section 3.3, “Copper Ethernet Port (If Equipped)”

Section 3.1
BNC Ports

The RUGGEDCOM RMC8388 features one or more BNC ports depending on the configuration of the device.

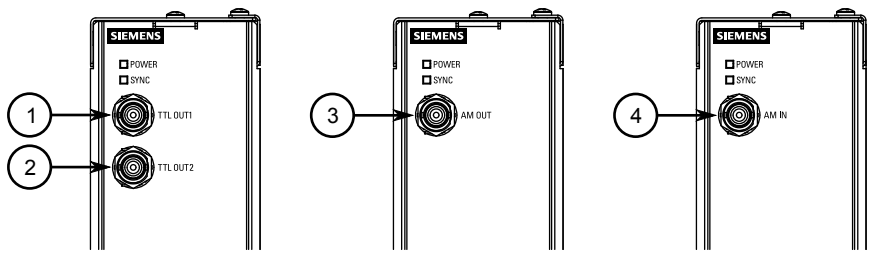

Figure 9: Available BNC Ports

1. TTL OUT1 Port **2.** TTL OUT2 Port **3.** AM OUT Port **4.** AM IN Port

- **TTL OUT1/TTL OUT2**
  Dual **TTL OUT** ports convert an IEEE 1588 v2 timing signal into two IRIG-B timing signals with either IEEE 1344 or C37.118.2011 extensions, or interval configurable PPS. Both IRIG-B out and PPS out are supported at the same time.

  Both ports provide IRIG-B Pulse Width Modulation (PWM), Pulse Per Second (1PPS), or Siemens' Pulse Per X (PPX) output. PPX allows users to set the pulse interval, pulse width and start time.

  The signal format is independently configurable for each port via RUGGEDCOM ROS.
- **AM OUT**
  The **AM OUT** port converts an IEEE 1588 v2 timing signal into an IRIG-B AM timing signal with either IEEE 1344 or C37.118.2011 extensions.
- **AM IN**
  The **AM IN** port converts an IRIG-B AM timing signal with either IEEE 1344 or C37.118.2011 extensions into an IEEE 1588 v2 timing signal.

For technical specifications related to the BNC ports, refer to Section 4.4, “PTP Specifications”.

Section 3.2
Fiber Optic Ethernet Port (If Equipped)

The 100Base-FX fiber optic Ethernet port uses an LC (Lucent Connector) connector. Make sure the Transmit (Tx) and Receive (Rx) connections of each port are properly connected and matched to establish a proper link.

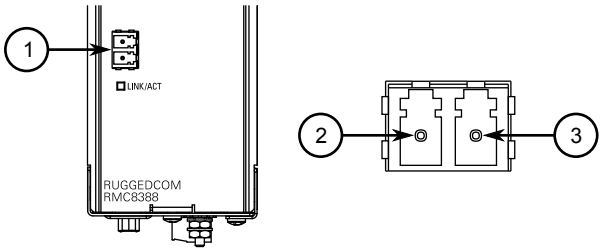

Figure 10: LC Port

1. LC Port **2.** Tx Connector **3.** Rx Connector

For technical specifications on the available fiber optic Ethernet ports, refer to Section 4.3, “Fiber Optic Ethernet Port Specifications”.

Section 3.3
Copper Ethernet Port (If Equipped)

The 100Base-TX copper Ethernet port features a standard RJ-45 connector or Siemens's FastConnect RJ-45 connector, both of which are directly connected to the chassis ground. Standard Category 5 (CAT-5) unshielded twisted-pair (UTP) or shielded twisted-pair (STP) cables can be used to connect to this port.

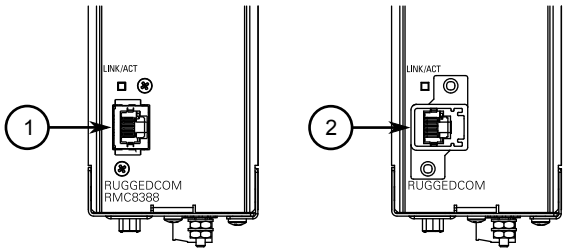

Figure 11: Copper Ethernet Port Options

1. Standard RJ-45 Connector **2.** Siemens FastConnect RJ-45 Connector

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 RJ-45 connectors 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.

IMPORTANT!

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.

NOTE

For more information about Siemens's FastConnect cabling system, visit www.siemens.com/ruggedcom.

The following is the pin-out for the standard and FastConnect RJ-45 connector options:

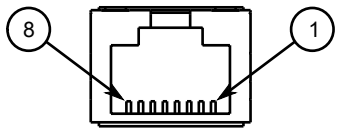

Figure 12: RJ-45 and FastConnect RJ-45 Ethernet Port Pin Configuration

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

For technical specifications on the copper Ethernet port, refer to Section 4.2, “Copper Ethernet Port Specifications”.

4 Technical Specifications

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

Section 4.1

Power Supply Specifications

The RUGGEDCOM RMC8388 includes one of the following internal power supplies:

CAUTION!
Electrical hazard – risk of damage to the device. Do not exceed the maximum input voltage specified for the 24 or 48 VDC power supplies.

Power Supply Type	Minimum Input	Maximum Input	Internal Fuse Rating[a]	Maximum Power Consumption
HI[b]	88 VDC	300 VDC	3.15 A(T)	7 W
	85 VAC	264 VAC		
48 VDC	38 VDC	72 VDC		
24 VDC	11 VDC	36 VDC		

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

[b] *Same power supply for both AC and DC.*

Section 4.2

Copper Ethernet Port Specifications

The following details the specifications for copper Ethernet ports that can be ordered with the RUGGEDCOM RMC8388.

Speed[c]	Interface	Connector	Duplex[c]	Cable Type[d]	Wiring Standard[e]	Maximum Distance[f]	Isolation[g]
100	TX	RJ45	Full Duplex	> CAT-5	TIA/EIA T568A/B	100 m (328 ft)	1.5 kV

Speed[c]	Interface	Connector	Duplex[c]	Cable Type[d]	Wiring Standard[e]	Maximum Distance[f]	Isolation[g]
100	TX	FastConnect RJ45	Full Duplex	> 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] *Typical distance. Dependent on the number of connectors and splices.*

[g] *RMS 1 minute.*

Section 4.3
Fiber Optic Ethernet Port Specifications

The following details the specifications for fiber optic Ethernet ports that can be ordered with the RUGGEDCOM RMC8388.

NOTE

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

Speed (Mbit/s)	Interface	Mode[h]	Connector Type	Cable Type (µm)	Tx/Rx λ (nm)[i]	Tx min (dbm)	Tx max (dBm)	Rx Sensitivity (dBm)	Distance (km)[i]	Power Budget (dB)
100	FX	MM	LC	62.5/125 50/125	1310	-19	-14	-32	2	13

[h] *MM = Multi-Mode*

[i] *Typical.*

Section 4.4
PTP Specifications

The following details the Precision Time Protocol (PTP) specifications for the available BNC ports:

IRIG-B PWM Output Specifications for TTL OUT Ports

Parameter	Specification
Output Current (I_s)	30 mA
Output Voltage (V_s)	TTL-Compatible
Output Impedance (R_s)	50 Ω

IRIG-B AM Output Specifications for the AM OUT Port

Parameter	Specification
Carrier Frequency	1 kHz
Modulation Depth	3:1±10%
Output Current (I_s)	15 mA
Output Impedance (R_s)	50 Ω
Output Voltage (V_s)	6 V_{p-p}

IRIG-B AM Input Specifications for the AM IN Port

Parameter	Specification
Input Voltage Range	2 to 7 V_{p-p}
Input Impedance	> 3.5 kΩ
Carrier Frequency	1 kHz
Modulation Depth	3:1±10%

Section 4.5

Operating Environment

The RUGGEDCOM RMC8388 can operate under the following environmental conditions:

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 4.6

Mechanical Specifications

Parameter	Value
Dimensions	Refer to Chapter 5, *Dimension Drawings*
Weight	1.1 kg (2.4 lbs)
Ingress Protection	IP30 (2.5 mm or 0.1 in objects)
Enclosure	21 AWG Galvanized Steel

5 Dimension Drawings

NOTE
All dimensions are in millimeters, unless otherwise stated.

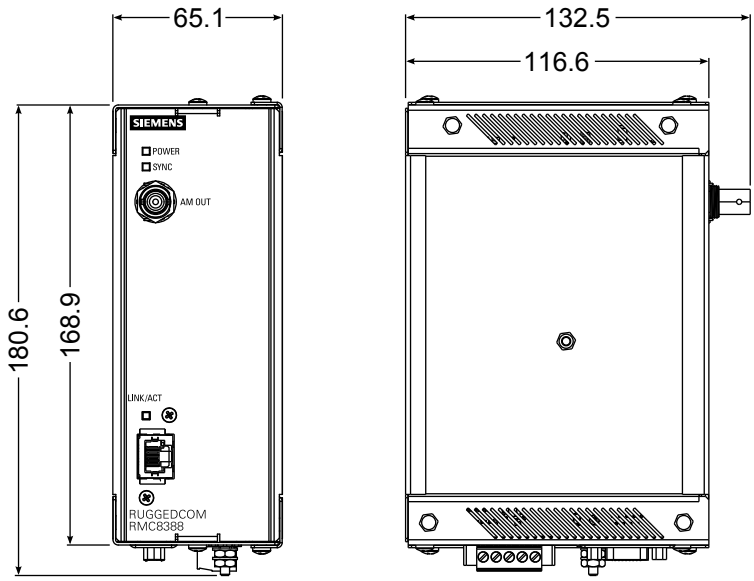

Figure 13: Overall Dimensions

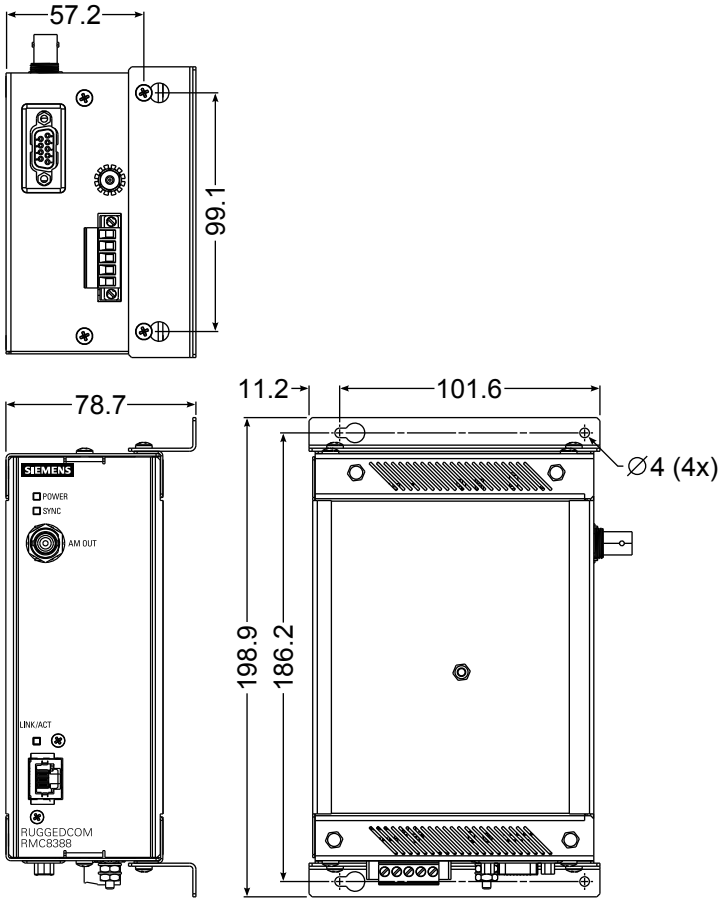

Figure 14: Panel Mount Dimensions

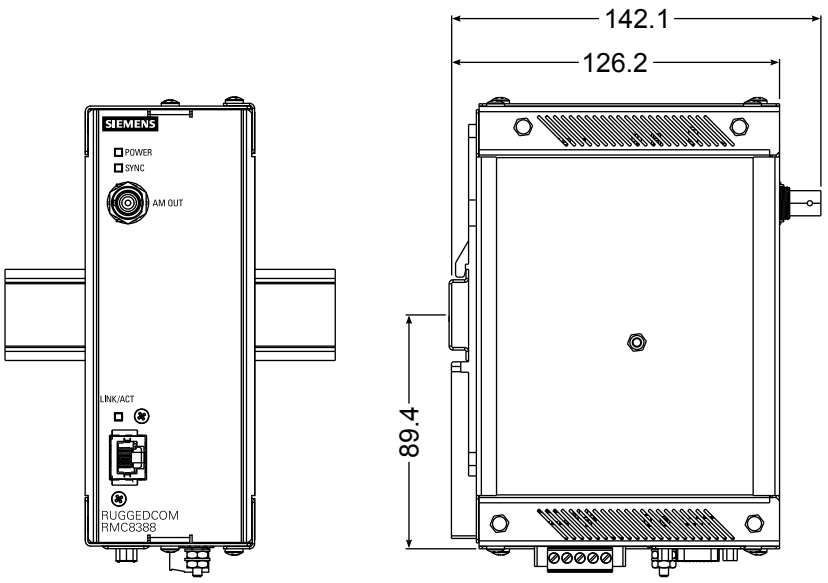

Figure 15: DIN Rail Mount Dimensions

6 Certification

The RUGGEDCOM RMC8388 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 RMC8388 complies with the following standards:

- **FCC Compliance**
  This device 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 device is operated in a commercial environment.

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

Section 6.3

EMI and Environmental Type Tests

The RUGGEDCOM RMC8388 has passed the following EMI and environmental tests.

IEC 61850-3 Type Tests

Test	Description		Test Levels	Severity Levels
IEC 61000-4-2	ESD	Enclosure Contact	+/- 8 kV	4
		Enclosure Air	+/- 15 kV	4
IEC 61000-4-3	Radiated RFI	Enclosure ports	20 V/m	Note[a]
IEC 61000-4-4	Burst (Fast Transient)	Signal Ports	+/- 4 kV @ 2.5 kHz	Note[a]
		DC Power Ports	+/- 4 kV	4
		AC Power Ports	+/- 4 kV	4
		Earth ground ports	+/- 4 kV	4
IEC 61000-4-5	Surge	Signal Ports	+/- 4 kV line-to-earth, +/- 2 kV line-to-line	4
		DC Power Ports	+/- 2 kV line-to-earth, +/- 1 kV line-to-line	3
		AC Power Ports	+/- 4 kV line-to-earth, +/- 2 kV line-to-line	4
IEC 61000-4-6	Induced (Conducted) RFI	Signal Ports	10 V	3
		DC Power Ports	10 V	3
		AC Power Ports	10 V	3
		Earth ground ports	10 V	3
IEC 61000-4-8	Magnetic Field	Enclosure ports	100 A/m continuous for 1 min, 1000 A/m for 1 s	Note[a]
			1000 A/m for 1 s	5
IEC 61000-4-9	Pulsed Magnetic Field	Enclosure ports	300 A/m	4
IEC 61000-4-29	Voltage Dips and Interrupts	DC Power Ports	30% for 0.1 s, 60% for 0.1 s, 100% for 0.05 s	
		AC Power Ports	30% for 1 period, 60% for 50 periods	
IEC 61000-4-11			100% for 5 periods, 100% for 50 periods	
IEC 61000-4-12	Damped Oscillatory	Signal Ports	2.5 kV common, 1 kV differential mode @ 1 MHz	3
		DC Power Ports	2.5 kV common, 1 kV differential mode @ 1 MHz	3

Test	Description		Test Levels	Severity Levels
		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 61000-4-18	Damped Oscillatory Wave	Slow Damped	2.5 kV common @ 100 kHz and 1 MHz for AC/ DC power and signal ports	3
			1 kV differential @ 100 kHz and 1 MHz for AC/DC power ports	
IEC 60255-5	Dielectric Strength	Signal Ports	2 kVAC (Fail-Safe Relay output)	
		DC Power Ports	1.5 kVDC	
		AC Power Ports	2 kVDC	
	HV Impulse	Signal Ports	5 kV (Fail-Safe Relay Output)	
		DC Power Ports	5 kV	
		AC Power Ports	5 kV	

[a] *Siemens specified severity level.*

IEEE 1613 EMI Immunity Type Tests

NOTE
The RUGGEDCOM RMC8388 meets Class 2 requirements for an all-fiber configuration and Class 1 requirements for copper ports.

Description		Test Levels
ESD	Enclosure Contact	+/- 2 kV, +/- 4 kV, +/- 8 kV
	Enclosure Air	+/- 4 kV, +/- 8 kV, +/- 15 kV
Radiated RFI	Enclosure ports	35 V/m
Fast Transient	Signal Ports	+/- 4 kV @ 2.5 kHz
	DC Power Ports	+/- 4 kV
	AC Power Ports	+/- 4 kV
	Earth ground ports	+/- 4 kV
Oscillatory	Signal Ports	2.5 kV common mode @ 1MHz
	DC Power Ports	2.5 kV common, 1 kV differential mode @ 1MHz
	AC Power Ports	2.5 kV common, 1 kV differential mode @ 1MHz
HV Impulse	Signal Ports	5 kV (Failsafe Relay)
	DC Power Ports	5 kV
	AC Power Ports	5 kV

Description		Test Levels
Dielectric Strength	Signal Ports	2 kVAC
	DC Power Ports	2.8 kVDC
	AC Power Ports	2 kVAC

Environmental Type Tests

Test	Description		Test Levels	Severity Levels
IEC 60068-2-1	Cold Operation	Test Ad	16 hours at -40 °C (-40 °F)	
	Cold Storage	Test Ab	16 hours at -40 °C (-40 °F)	
IEC 60068-2-2	Dry Heat Operation	Test Bd	16 hours at 85 °C (185 °F)	
	Dry Heat Storage	Test Bb	16 hours at 85 °C (185 °F)	
IEC 60068-2-14	Change of Temperature		5 cycles at -40 to 85 °C (-40 to 185 °F) and 3 hour dwells at rate of 1 °C/min (1.8 °F/min)	
IEC 60068-2-30	Humidity (Damp Heat, Cyclic)	Test Db	6 cycles at 55 °C (131 °F) and 95% relative humidity (non-condensing)	
IEC 60068-2-31	Free Fall		Procedure 1, 2 falls from a height of 250 mm (9.8 in)	
IEC 60068-2-78	Humidity (Damp Heat, Steady State)		10 days at 55 °C (131 °F) and 93% relative humidity (non-condensing)	
IEC 60255-21-1	Vibration		2 g @ 10-150 Hz	Class 2
IEC 60255-21-2	Shock		30 g @ 11 ms	Class 2
IEC 60255-21-3	Seismic		Level 2	Method A
IEC 60870--2-2	Static Load		5 kPa for 1 min	