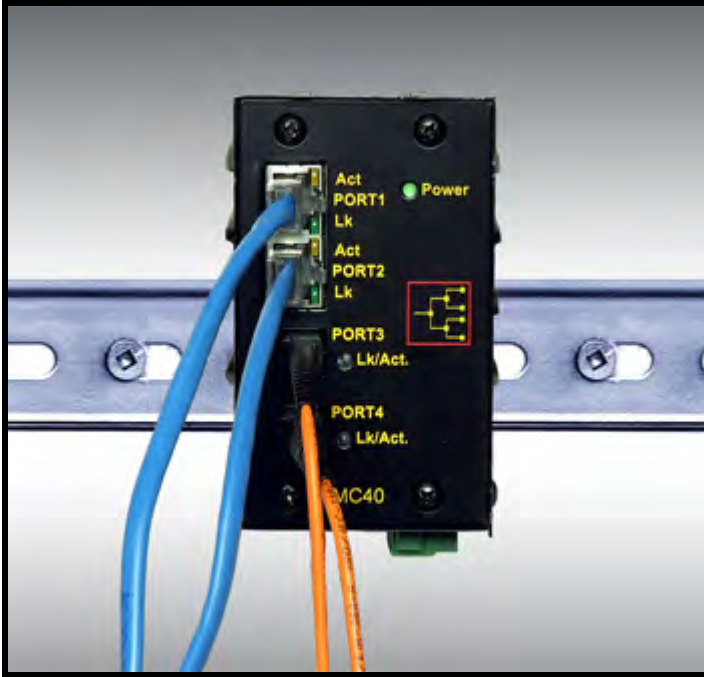


# RuggedMC™ RMC40

## Installation Guide



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## Disclaimer of liability

We have checked the contents of this manual against the hardware and software described. However, deviations from the description cannot be completely ruled out.

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The information given in this document is reviewed regularly and any necessary corrections will be included in subsequent editions. We appreciate any suggested improvements. We reserve the right to make technical improvements without notice.

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## Federal Communications Commission Radio Frequency Interference Statement

*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.*

Warning: Changes or modifications not expressly approved by RuggedCom Inc. could void the user's authority to operate the equipment.

**Caution** – This product contains a laser system and is classified as a  
“CLASS 1 LASER PRODUCT”

Caution – Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure. This product contains no user-serviceable parts. Attempted service by unauthorized personnel shall render all warranties null and void.

Should this device require service see the “Warranty and Service” section of this installation guide.

### **Important:**

The RuggedMC™ should be installed in a restricted access location where access can only be gained by service personnel or users who have been instructed about the reasons for the restrictions applied to the location and about any precautions that shall be taken; and access is through the use of a tool or lock and key, or other means of security, and is controlled by the authority responsible for the location.

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# 1 Product Overview

## 1.1 Functional Overview

The **Rugged MediaConverter™** is an industrially hardened fiber optical media converter specifically designed to operate in harsh environments such as those found in electric utility substations and factory floors. The RMC40™ provides industrial strength Ethernet copper-to-fiber media conversion, providing copper-based 10BaseT or 100BaseTx clients 100BaseFX fiber optical connectivity.

Specifically tested to the same standards as mission critical protective relaying equipment (i.e. ANSI/IEEE C37.90 and IEC 60255), and the newly issued IEC 61850-3 “Communications Systems and Networks in Substations” standard, the RuggedMC™ is ideally suited for substation or industrial environments. The reliability of the Rugged MediaConverter™ family exceeds that of commercial media converters by having no rotating mechanical parts (i.e. no cooling fans), utilizing high-temperature solid state components and incorporating the necessary transient and surge suppression circuitry required for substation and harsh industrial environments.

## 1.2 Feature Highlights

- Utility Grade (i.e. substation hardened) per ANSI/IEEE C37.90, IEC 60255, and the new IEC 61850-3 (2002), IEC 61000-6-5 standards
- Operating temperature: -40° to 85°C (no fan)
- Radiated RF Immunity: 35V/m per ANSI/IEEE C37.90.2
- Power supply options: 24 (18-36VDC), 48 (36-72) or HI (88-300VDC / 85-264VAC)
- 2 – 10/100BaseTx RJ45 style auto-negotiating Ethernet ports
- Choice of one of the following:
  - 1 – 100BaseFX (100Mbps) SC style connector (multimode or single-mode) transceiver
  - 2 - 100BaseFX (100Mbps) MTRJ (multimode) or LC (single-mode) style transceivers
- Full-Duplex operation on all ports (no collisions)
- Non-blocking, low latency switching with IEEE 802.3x flow-control protocol results in high-speed reliable communications.

### 1.3 RuggedMC™ Front Panel Description

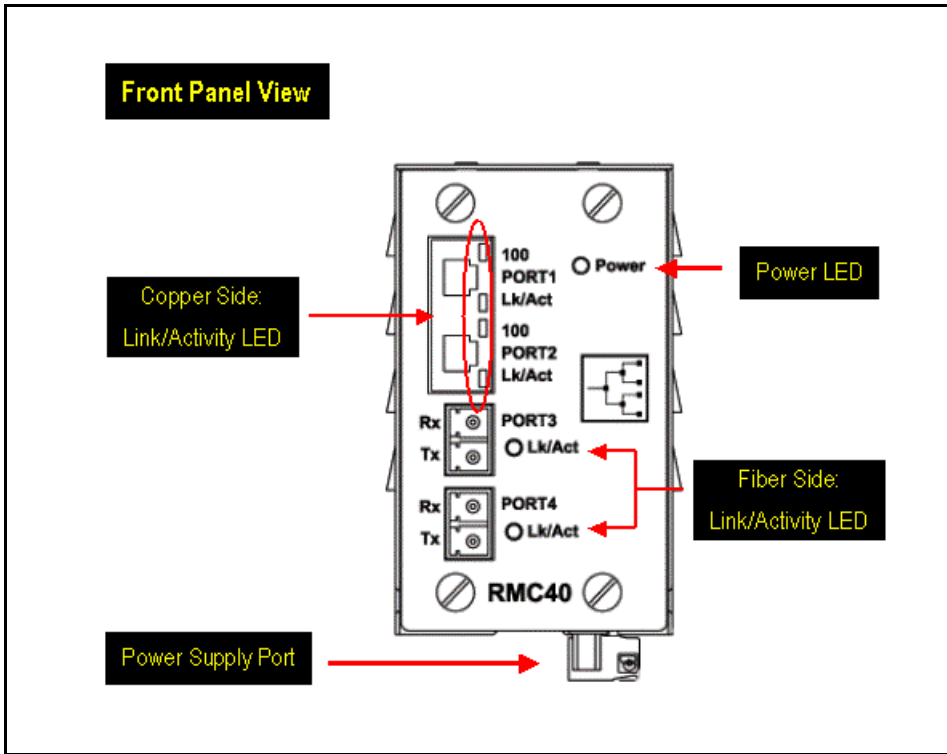


Figure 1: RuggedMC™ Front Panel Detail (Dual LC Style 100BaseFX fiber optic connector shown)

ITEM	Activity	Comments
RJ45: Lk/Act	Solid (Yellow)	Link Established
	Blinking (Yellow)	Tx, Rx Activity
RJ45: 100	Solid (Yellow)	100Mbps Operation
	Off	10Mbps Operation
Fiber: Lk/Act	Solid (Yellow)	Link Established
	Blinking (Yellow)	Tx, Rx Activity
Power LED	Solid (Green)	Power On

## 1.4 RuggedMC™ Side and Bottom View

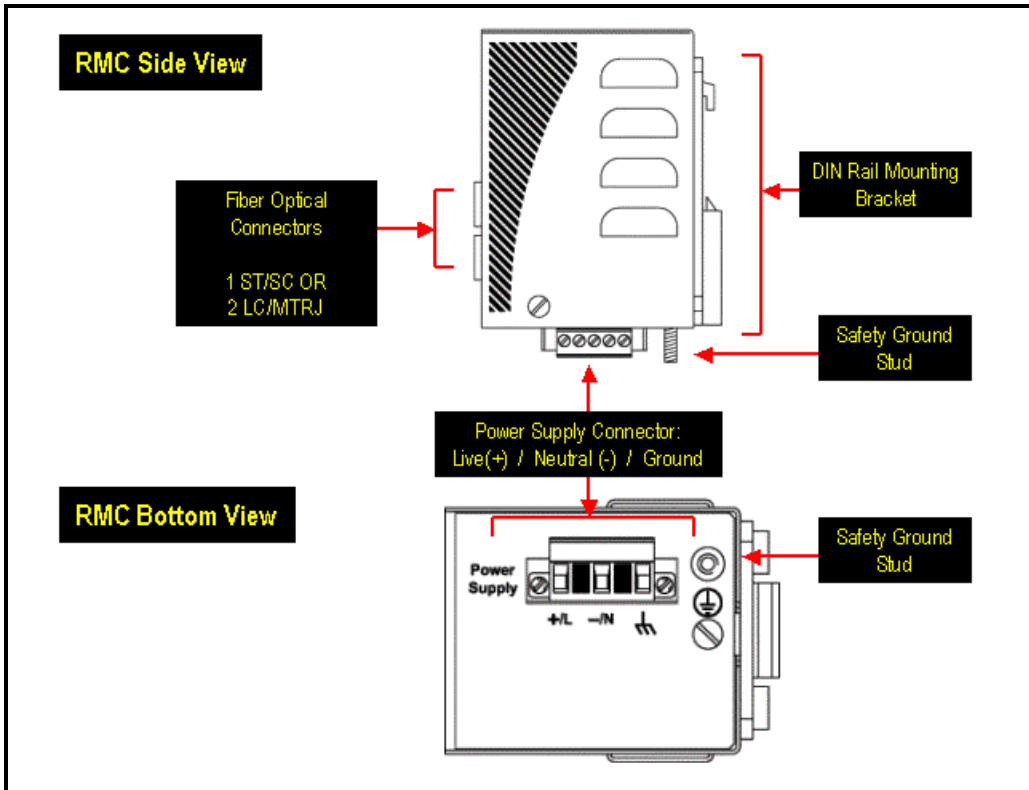


Figure 2: RuggedMC™ Side and Bottom View

## 2 Installation

### 2.1 DIN Rail Mounting

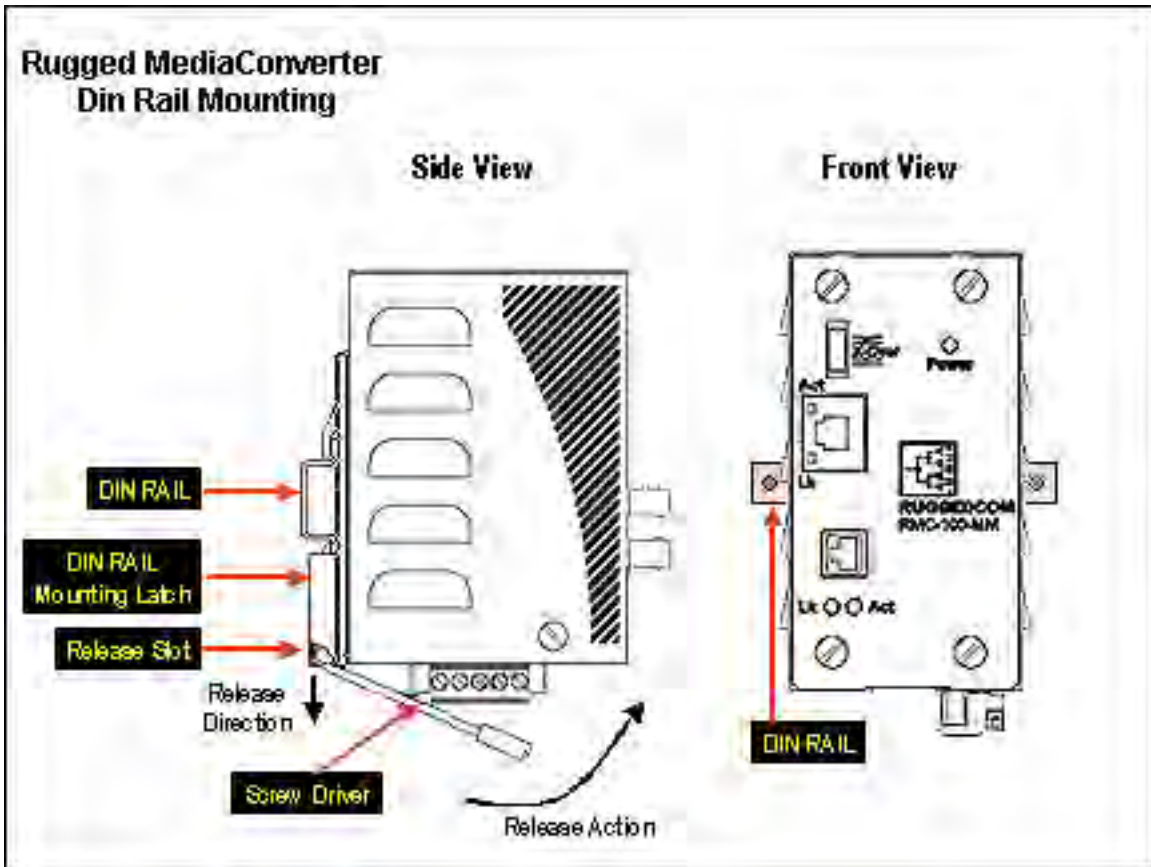


Figure 3: RuggedMC™ DIN Rail Mounting

## 2.2 Panel Mounting

With the use of an optional panel-mount adapter, the RuggedMC™ series of media converters can be panel mounted. The drawing shown in Figure 4 shows an example of an RMC unit panel mounted using the optional panel mount adapter.

The panel mount adapter can be secured to a panel with three screws. The RuggedMC™ product is easily mounted onto the panel mount adapter via the two metal clips on either side of the unit, and a single screw located on the bottom.

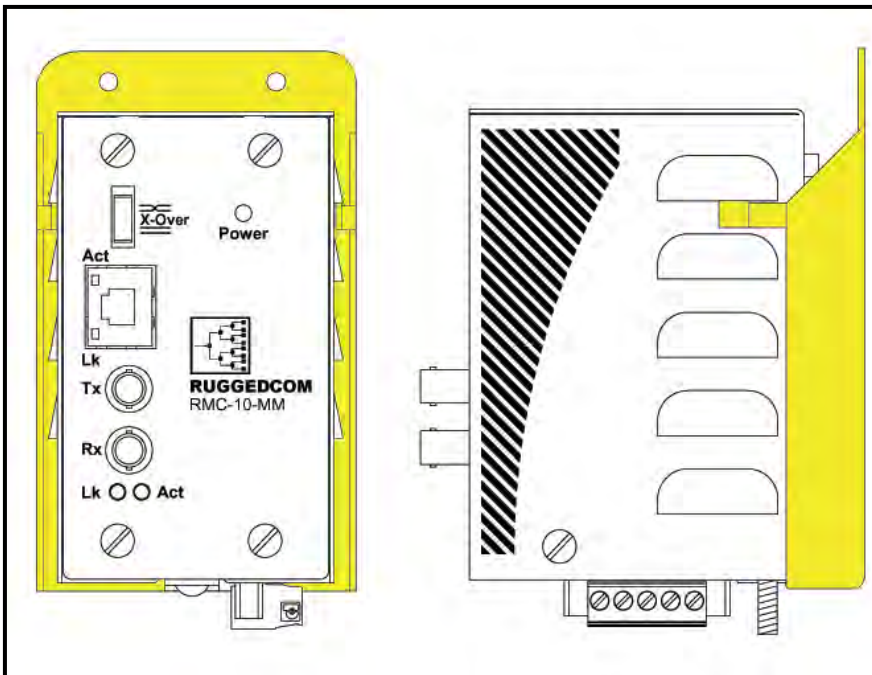


Figure 4: RuggedMC™ panel mounted using optional panel mount mounting adapter

## 2.3 Power Supply Wiring and Grounding

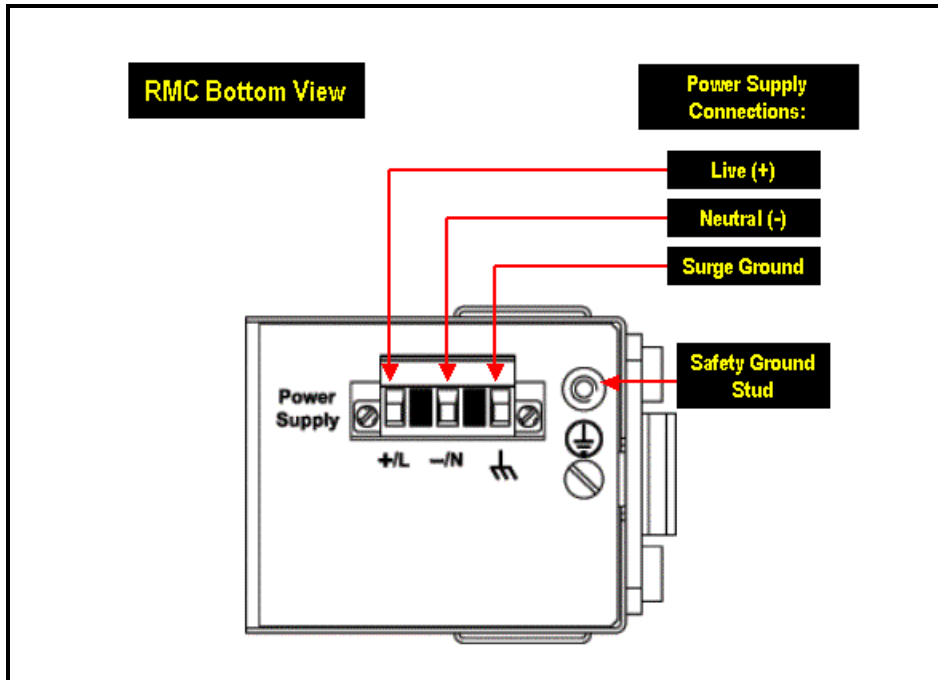


Figure 5: RuggedMC™ Power Supply Inputs

The RuggedMC™ power supply inputs are identical and are connected as follows:

1. **+/L** = DC (+) / AC (Hot) is connected to the positive (+) terminal if the power source is DC or to the (Hot) terminal if the power source is AC.
2. **-/N** = DC (-) / AC (Neutral) is connected to the negative (-) terminal if the power source is DC or to the (Neutral) terminal if the power source is AC.
3. **Surge Ground** is connected to the Chassis Ground via a braided cable or other appropriate grounding wire. Surge Ground is used as the ground conductor for all surge and transient suppression circuitry internal to the RuggedMC™.

*Chassis Ground is connected to the Safety Ground terminal for AC inputs or the equipment ground bus for DC inputs.*

**Note:** *Surge Ground must be disconnected from Chassis Ground during HIPOT (dielectric strength) testing.*

**Notes:**

1. *For 125/250VDC rated equipment: An appropriately rated 300VDC circuit breaker must be installed within 3 meters of unit.*
2. *For 110/230VAC rated equipment: An appropriately rated 250VAC circuit breaker must be installed within 3 meters of the unit*
3. *A circuit breaker is not required for 48 or 24VDC rated equipment.*
4. *For multiple supplies, separate circuit breakers must be installed. Equipment must be installed according to the applicable country wiring codes.*

## 2.4 RJ45 Ports – Signal Description

The RJ45 port accepts standard category 5 unshielded twisted pair (UTP), or screened twisted pair (STP) cable with RJ45 male connectors. Figure 6 shows the RJ45 port pin configuration. Both RJ45 Ethernet ports on the RMC40™ are auto-crossover, auto-polarity, auto-crossover (MDI / MDIX) equipped, for simple plug-and-play operation.

Although transient suppression circuitry is present on all RJ45 ports, they **cannot** protect the port from high-amplitude, high-energy transients that can potentially damage the RMC40™ and its link partners. In general, RuggedCom strongly recommends limiting connections used by the RJ45 ports to those that are less than 3m in length, or limited to environments sufficiently protected from such transients.

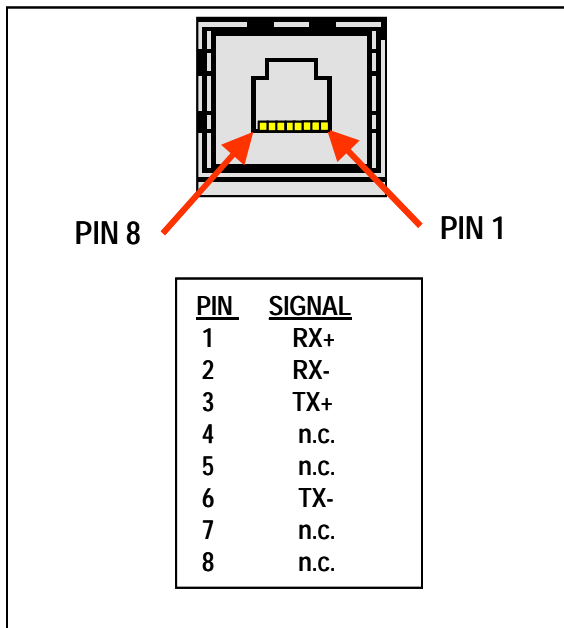


Figure 6: RJ45 Port Pins

**NOTE:** For substation applications it is not recommended to use these ports to interface to field devices across distances which could produce high levels of ground potential rise (GPR), (i.e. greater than 2500V) during line-to-ground fault conditions.

### 3 Specifications

#### 3.1 Power Supply Specifications

<i>Power Supply Type</i>	<i>Minimum Input</i>	<i>Maximum Input</i>	<i>Internal Fuse Rating</i>	<i>Maximum Power Consumption</i>
24 VDC	18 VDC	36 VDC	3.15A(T) <sup>2</sup>	3 W
48 VDC	36 VDC	72 VDC	3.15A(T) <sup>2</sup>	
HI (88/300 VDC) <sup>1</sup> HI (120/240 VAC) <sup>1</sup>	88 VDC 85 VAC	300 VDC 264 VAC	3.15A(T) <sup>2</sup>	

Notes: 1 – This is the same power supply for both AC and DC.

2 – (T) Denotes time-delay fuse

#### 3.2 Twisted-Pair Port Specifications

<i>Parameter</i>	<i>Specification</i>	<i>Notes</i>
Speed	10/100 Mbps	Auto-negotiating
Duplex	FDX / HDX	Auto-negotiating
Cable-Type	> Category 5	Shielded/Unshielded
Wiring Standard	TIA/EIA T568A/B	Auto-Crossover, Auto-polarity
Max Distance	100m	
Connector	RJ45	
Isolation	1.5kV	RMS 1-minute

### 3.3 Fiber Optical Port Specifications

<i>Speed Standard</i>	<i>Mode / Connector</i>	<i>Tx <math>\lambda</math> (nm)</i>	<i>Cable Type<sup>2</sup> (<math>\mu</math>m)</i>	<i>Tx Pwr (dBm peak)<sup>3</sup> (Min / Max)</i>	<i>Rx Sensitivity (dBm Average)<sup>3</sup></i>	<i>Rx Saturation (dBm Peak)<sup>3</sup></i>	<i>Typical Distance (km)<sup>1</sup></i>	<i>Power Budget (dB)</i>
100BaseFX	MM / ST	1310	50/125	-15.7	-33.5	-11	2	17
100BaseFX	MM / SC	1310	50/125	-16/-11	-33	-11	2	17
100BaseFX	MM / LC	1310	50/125	-19 / -14	-32	-14	2	15
100BaseFX	MM / MTRJ	1310	50/125	-16/-11	-33.5	-11	2	17
100BaseFX	SM / SC	1310	9/125	-13/5	-31	-4	20	20
100BaseFX	SM / LC	1310	9/125	-15/-8	-31	-5	15	16.5

Notes:

1. Maximum segment length is greatly dependent on factors such as fiber quality, and number of patches and splices. Please consult RuggedCom sales associates when determining maximum segment distances.
2. To convert from average to peak add 3 dBm. To convert from peak to average, subtract 3 dBm.

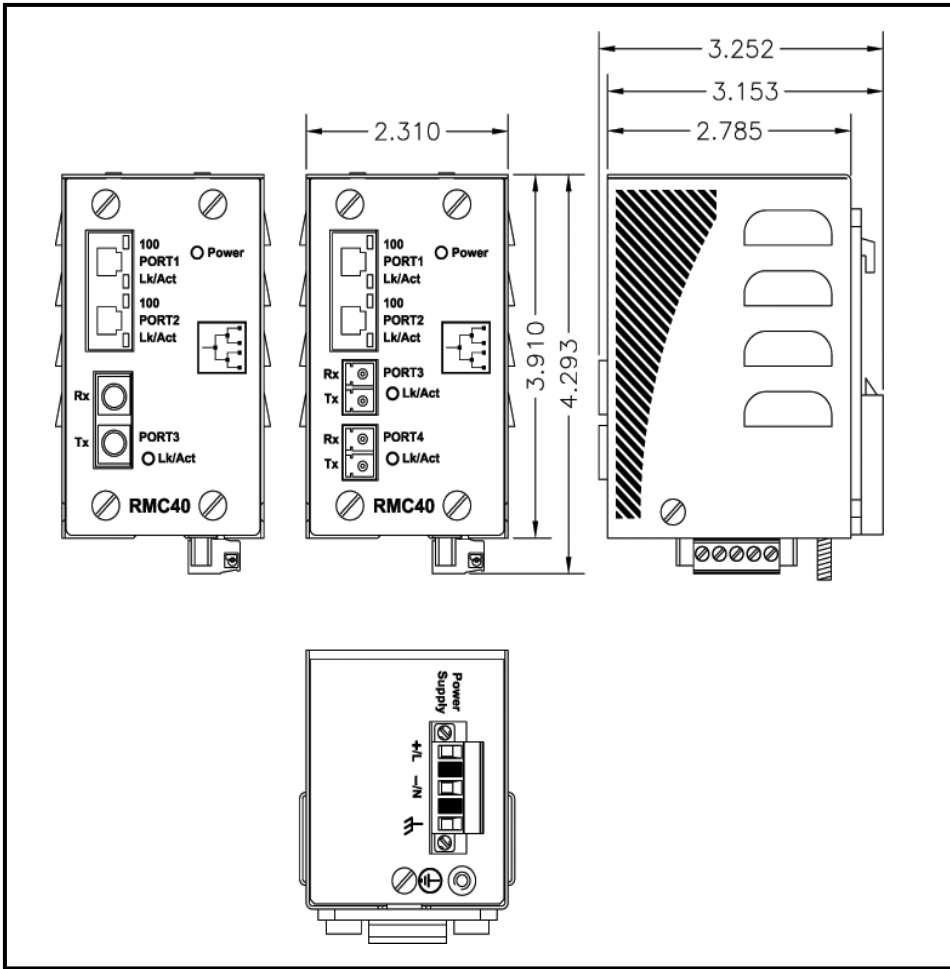
### 3.4 Networking Standards Supported

<i>Parameter</i>	<i>10FL Module</i>	<i>100FX Module</i>	<i>Notes</i>
IEEE 802.3	✓		10BaseT
IEEE 802.3u		✓	100BaseTX / 100BaseFX
IEEE 802.3x	✓	✓	FDX, Flow Control

### 3.5 Operational Specifications

<i>Parameter</i>	<i>Specification</i>	<i>Notes</i>
Conversion Type	Cut-Through	High-speed, non-blocking
Mac Address Table Length	2048	
Frame Buffer Memory	1Mbit	

### 3.6 Mechanical Specifications



<i>Parameter</i>	<i>Value</i>	<i>Comments</i>
Dimensions	4.30 x 2.40 x 3.30 inches (110) x (61) x (84) mm	(Length x Width x Height)
Weight	1.5 lb (0,68 Kg)	
Enclosure	18 gauge Galvanized Steel	

### 3.7 Operating Environment

<i>Parameter</i>	<i>Range</i>	<i>Comments</i>
Ambient Operating Temperature	-40 to 85°C	Ambient Temperature as measured from a 30cm radius surrounding the center of the RuggedMC™ enclosure.
Ambient Relative Humidity	5% to 95%	Non-condensing
Ambient Storage Temperature	-40 to 85°C	

## 4 Type Tests

### 4.1 IEC 61850-3 Type Tests

Test	Description		Test Levels	Severity Levels
IEC 61000-4-2	ESD	Enclosure Contact	+/- 8kV	4
		Enclosure Air	+/- 15kV	4
IEC 61000-4-3	Radiated RFI	Enclosure ports	20 V/m	x
IEC 61000-4-4	Burst (Fast Transient)	Signal ports	+/- 4kV @ 2.5kHz	x
		D.C. Power ports	+/- 4kV	4
		A.C. Power ports	+/- 4kV	4
		Earth ground ports	+/- 4kV	4
IEC 61000-4-5	Surge	Signal ports	+/- 4kV line-to-earth, +/- 2kV line-to-line	4
		D.C. Power ports	+/- 2kV line-to-earth, +/- 1kV line-to-line	3
		A.C. Power ports	+/- 4kV line-to-earth, +/- 2kV line-to-line	4
IEC 61000-4-6	Induced (Conducted) RFI	Signal ports	10V	3
		D.C Power ports	10V	3
		A.C. Power ports	10V	3
		Earth ground ports	10V	3
IEC 61000-4-8	Magnetic Field	Enclosure ports	40 A/m continuous, 1000 A/m for 1 s	N/A
IEC 61000-4-29	Voltage Dips & Interrupts	D.C. Power ports	30% for 0.1s, 60% for 0.1s, 100% for 0.05s	N/A
IEC 61000-4-11		A.C. Power ports	30% for 1 period, 60% for 50 periods 100% for 5 periods, 100% for 50 periods <sup>2</sup>	N/A
IEC 61000-4-12	Damped Oscillatory	Signal ports	2.5kV common, 1kV differential mode @ 1MHz	3
		D.C. Power ports	2.5kV common, 1kV differential mode @ 1MHz	3
		A.C. Power ports	2.5kV common, 1kV differential mode @ 1MHz	3
IEC 61000-4-16	Mains Frequency Voltage	Signal ports	30V Continuous, 300V for 1s	4
		D.C. Power ports	30V Continuous, 300V for 1s	4
IEC 61000-4-17	Ripple on D.C. Power Supply	D.C. Power ports	10%	3
IEC 60255-5	Dielectric Strength	Signal ports	2kV AC (Fail-Safe Relay output)	N/A
		D.C. Power ports	1.5kVDC	N/A
		A.C. Power ports	2kVAC	N/A
IEC 60255-5	H.V. Impulse	Signal ports	5kV (Fail-Safe Relay output)	N/A
		D.C. Power ports	5kV	N/A
		A.C. Power ports	5kV	N/A

Table 1 - IEC 61850-3 Type Tests

## 4.2 IEEE 1613 Type Tests

IEEE Test	IEEE 1613 Clause	Description		Test Levels
C37.90.3	9	ESD	Enclosure Contact	+/- 8kV
			Enclosure Air	+/- 15kV
C37.90.2	8	Radiated RFI	Enclosure ports	35 V/m
C37.90.1	7	Fast Transient	Signal ports	+/- 4kV @ 2.5kHz
			D.C. Power ports	+/- 4kV
			A.C. Power ports	+/- 4kV
			Earth ground ports	+/- 4kV
C37.90.1	7	Oscillatory	Signal ports	2.5kV common mode @ 1MHz
			D.C. Power ports	2.5kV common & differential mode @ 1MHz
			A.C. Power ports	2.5kV common & differential mode @ 1MHz
C37.90	6	H.V. Impulse	Signal ports	5 kV (Failsafe Relay)
			D.C. Power ports	5 kV
			A.C. Power ports	5 kV
C37.90	6	Dielectric Strength	Signal ports	2kVAC
			D.C. Power ports	1.5kVDC
			A.C. Power ports	2kVAC

Table 2 - IEEE 1613 Type Tests

## Notes:

- If the unit contains copper ports, the IEEE 1613 conformance is Class 1 (During disturbance, errors may occur but recovery is automatic).
- If the unit contains all fiber ports, the IEEE 1613 conformance is Class 2 (During disturbance, no errors will occur).

## 4.3 IEC Environmental Type Tests

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

Table 3 - Environmental Type Tests

## Note:

- Class 2 refers to “Measuring relays and protection equipment for which a very high security margin is required or where the vibration levels are very high, (e.g. shipboard application and for severe transportation conditions).”

## 5 Agency Approvals

<i>Agency</i>	<i>Standards</i>	<i>Comments</i>
CSA, CE	CSA C22.2 No. 60950, UL 60950, EN 60950 EN 61000-6-2	Approved
FCC	FCC Part 15, Class A	Approved
CISPR	EN55022, Class A	Approved
FDA/CDRH	21 CFR Chapter 1, Subchapter J	Compliant
IEC/EN	EN60825-1:1994 + A11:1996 + A2:2001	Compliant

## 6 Warranty

RuggedCom warrants this product for a period of five (5) years from date of purchase. For warranty details, visit <http://www.ruggedcom.com/> or contact your customer service representative.

Should this product require warranty or service contact the factory at:

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