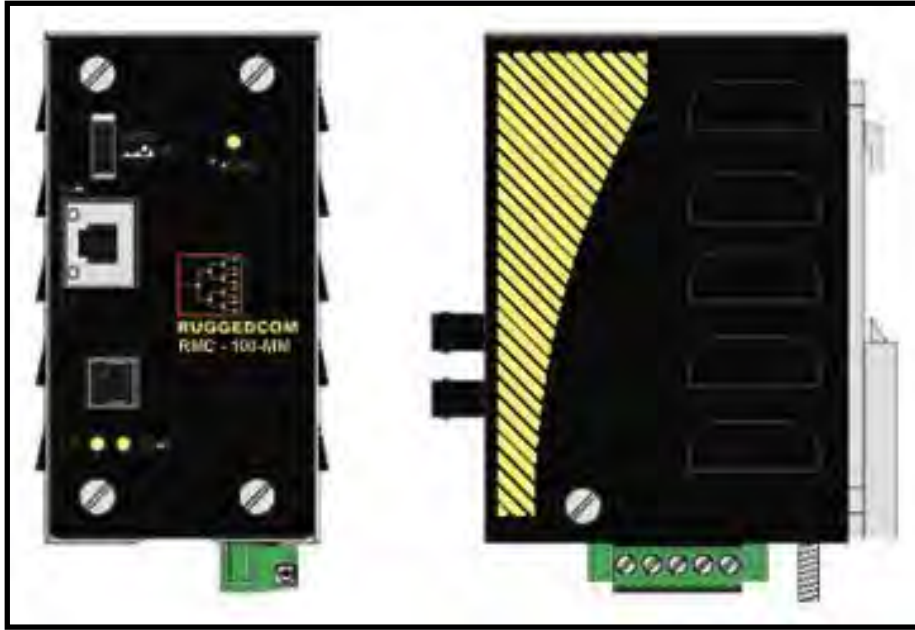


Rugged MediaConverter™

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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Important:

The Rugged MediaConverter™ (RuggedMC™) contains no user-serviceable parts. Attempted service by unauthorized personnel shall render all warranties null and void.

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

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 **RuggedMC™** family provides industrial strength Ethernet copper-to-fiber media conversion, allowing for 10BaseT-to-10BaseFL or 100BaseTX-100BaseFX over multi-mode or optional single-mode fiber optical media.

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)
- Choice of two fiber optical modules:
 - 1 – 100BaseFX (100Mbps) multimode or optional single-mode fiber optical port
 - 1 - 10BaseFL (10Mbps) multimode or optional single-mode fiber optical port
- 1 – 10/100BaseTX Auto-Negotiating RJ45 port
- Configurable Full-Duplex, Half-Duplex or Fiber-side negotiation support
- Link Pass Through support
- TIA/EIA-785 100BaseSX support (10FL module only)

1.3 RuggedMC™ Front Panel Description

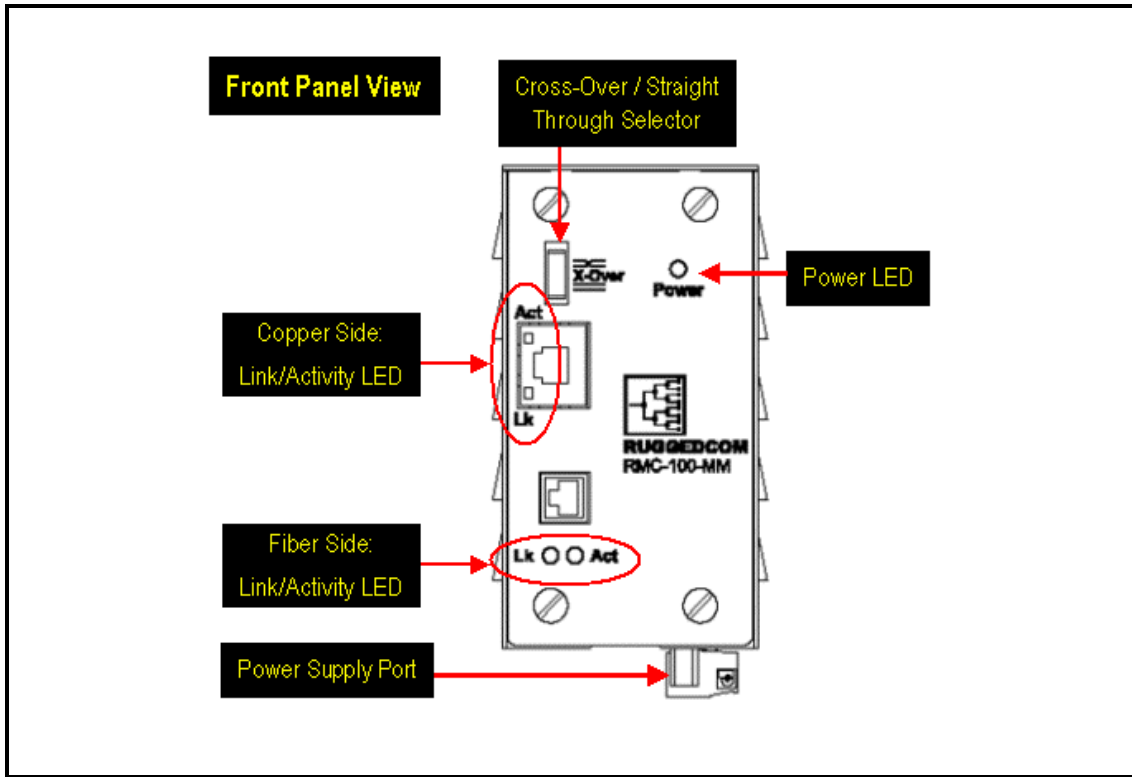


Figure 1: RuggedMC™ Front Panel Detail

<i>ITEM</i>	<i>Activity</i>	<i>Comments</i>
Copper Side: Link	Solid (Yellow)	Link Established
Copper Side: Activity	Blinking (Yellow)	Tx, Rx Activity
Fiber Side: Link	Solid (Yellow)	Link Established
Fiber Side: Activity	Blinking (Yellow)	Tx, Rx Activity
Power LED	Solid (Green)	Power On

1.4 RuggedMC™ Side and Bottom View

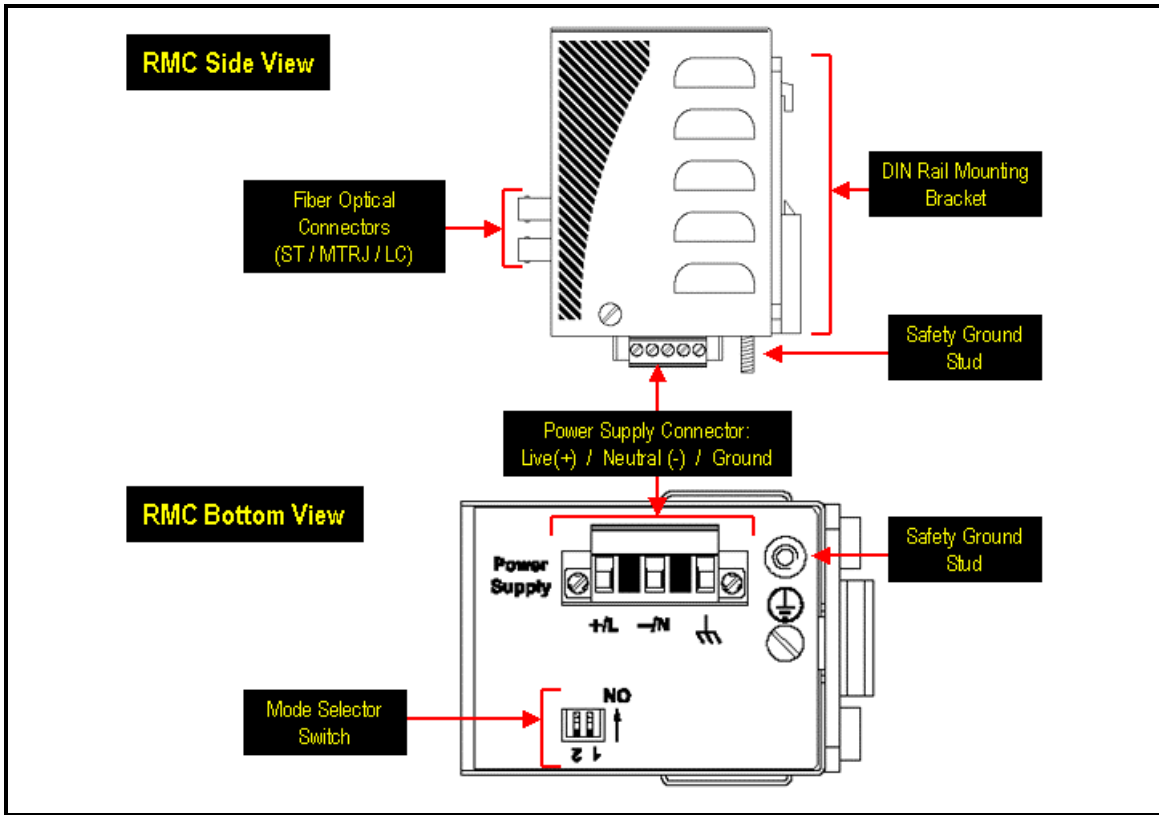


Figure 2: RuggedMC™ Side and Bottom View

2 Installation

2.1 DIN Rail Mounting

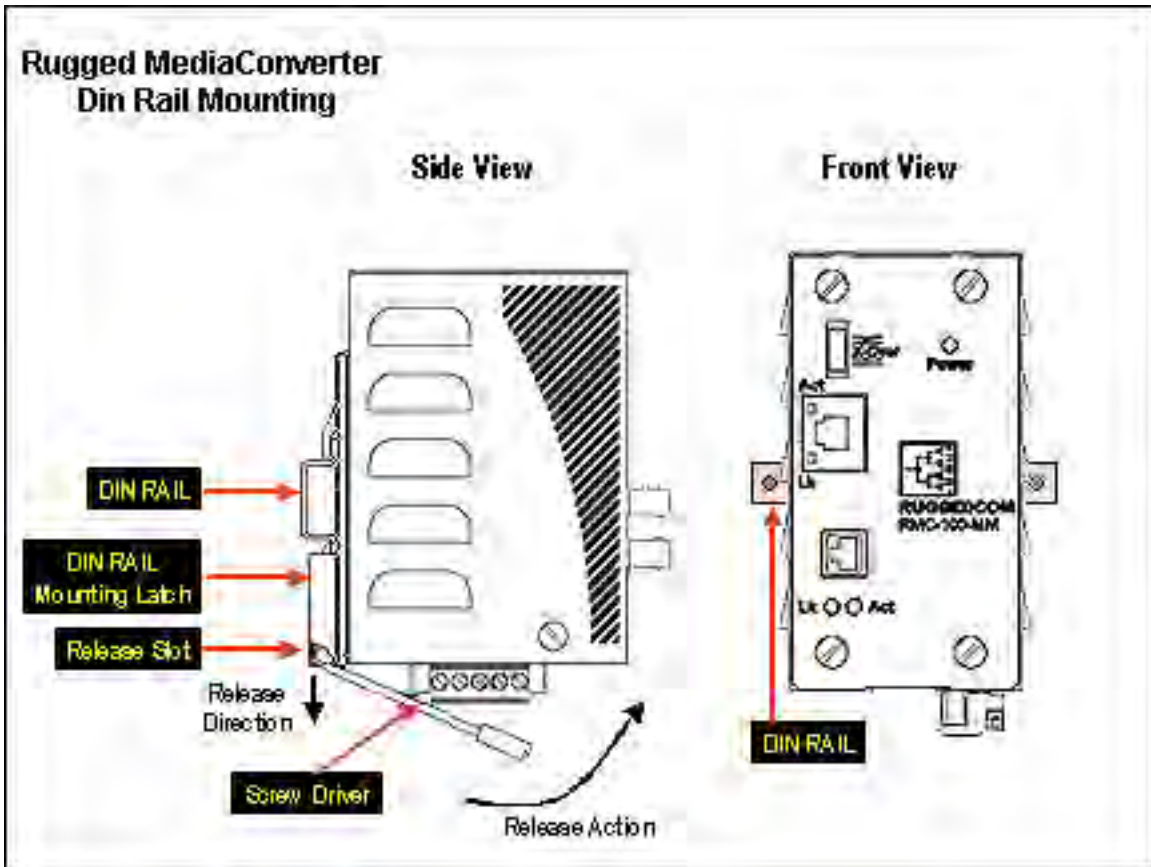


Figure 3: RuggedMC™ DIN Rail Mounting

2.2 Power Supply Wiring and Grounding

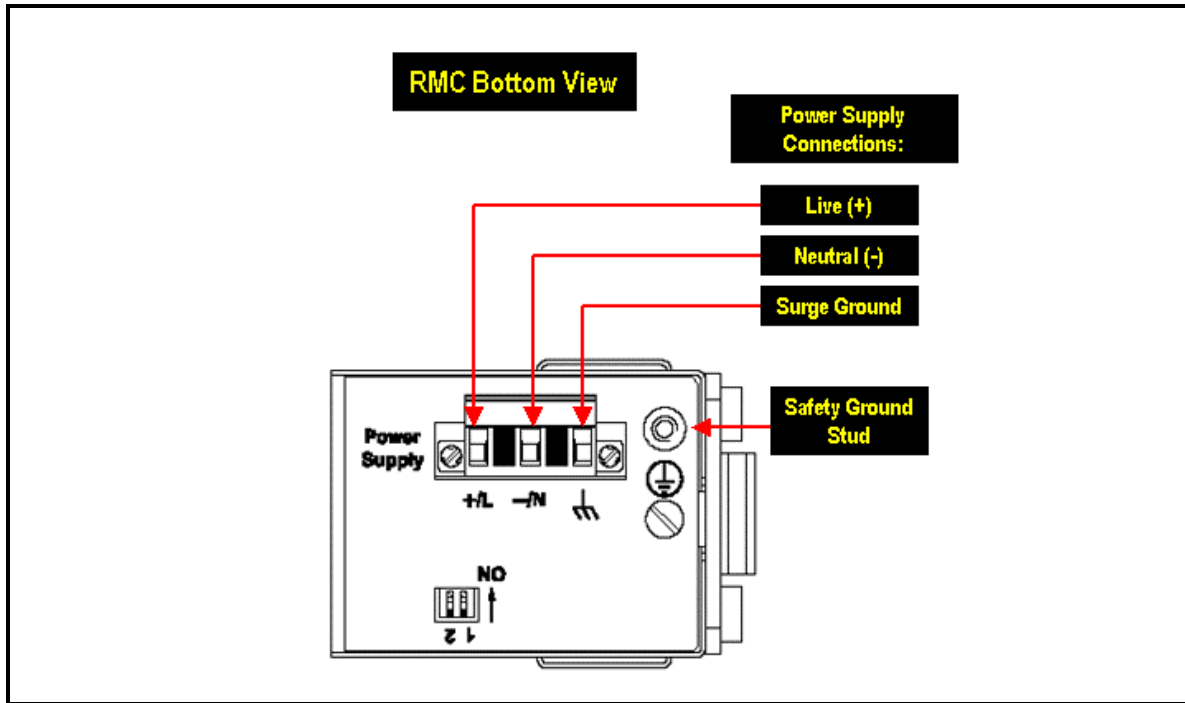


Figure 4: RuggedMC™ Power Supply Inputs

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.*

2.3 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 5 shows the RJ45 port pin configuration.

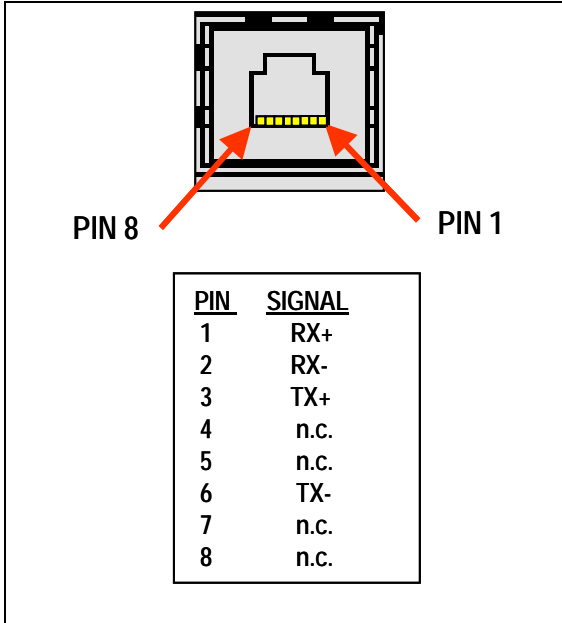


Figure 5: RJ45 Port Pins

To accommodate signals from end devices as well as network switching equipment, the RuggedMC™ is equipped with a crossover selection switch.

Category 5 network cabling can be constructed in two configurations: Straight through, and crossover (X-over). Straight through cabling involves a pin-to-pin connection, while crossover cabling matches the transmitting differential pair to the receiving differential pair. Table 1 summarizes the two possible configurations.

<i>TIA 568B Straight Through Pinout</i>				<i>TIA 568B Crossover Wiring Pinout</i>			
<i>Device 1</i>		<i>Device 2</i>		<i>Device 1</i>		<i>Device 2</i>	
<i>Pin</i>	<i>Colour</i>	<i>Pin</i>	<i>Colour</i>	<i>Pin</i>	<i>Colour</i>	<i>Pin</i>	<i>Colour</i>
1	White/Orange	1	White/Orange	1	White/Orange	1	White/Green
2	Orange	2	Orange	2	Orange	2	Green
3	White/Green	3	White/Green	3	White/Green	3	White/Orange
6	Green	6	Green	6	Green	6	Orange

Table 1 - Category 5 network cabling configurations: Straight through and Crossover

To accommodate both types of cabling, the RuggedMC™ contains a crossover selection switch visible on the front panel as shown in Table 2. This switch will allow for the proper connection regardless of the cable type configuration.

When connecting to end devices, the X-over switch should be selected to reflect the type of cabling used. (i.e. Straight through is selected when using straight through cabling, X-over is selected when using crossover cabling)

<i>X-Over Position</i>	<i>Description</i>
UP	Crossover cabling is used to connect to end devices.
DOWN	Straight-through cabling is used to connect to end devices.

Table 2 - X-over switch positioning for Straight through and Crossover cabling

The presence of an active LINK LED indicates that the X-over selection switch is in the proper position.

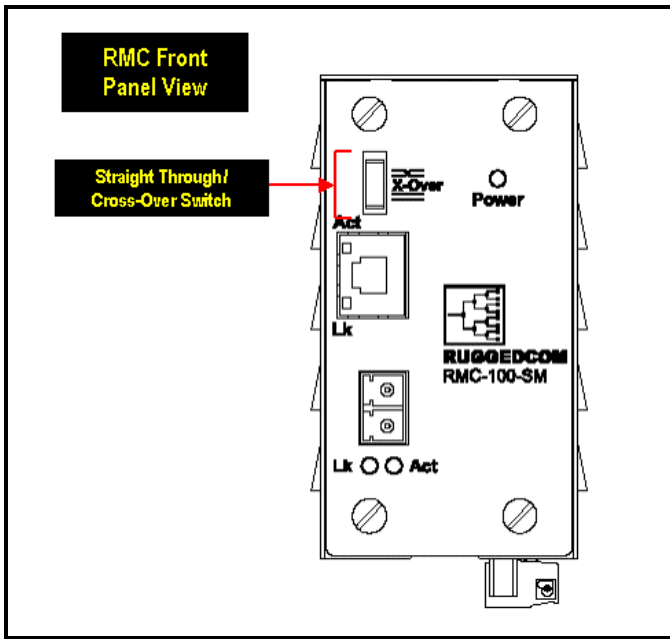


Figure 6: Location of X-over Switch on RuggedMC™

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.

2.4 Fiber Optical Port Configuration

To accommodate a wide array of fiber optical devices, the RuggedMC™ is equipped with a mode selector switch located on the bottom panel as shown in Figure 7.

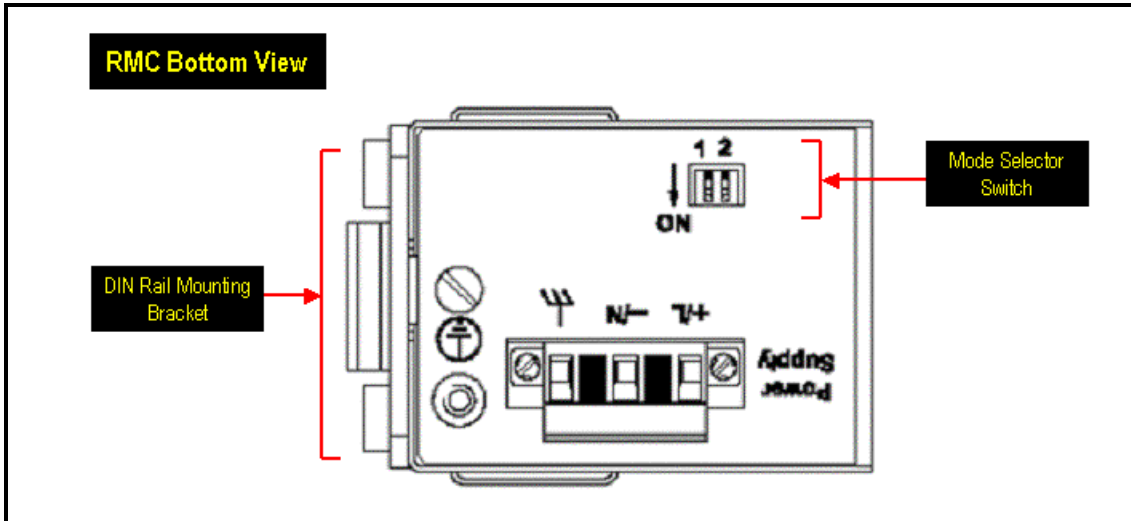


Figure 7: Mode Selector Switch located on the bottom of the RuggedMC™

The mode selector switch configures the RuggedMC™ to accommodate different fiber partners that operate at various duplex modes and speeds. Choose the appropriate operating mode according to the fiber link partner.

Configuration Mode	Mode Selector Positioning		Description
	SW1	SW2	
Transparent Mode*	OFF	OFF	10/100 Auto-negotiating transparent mode
HDX Mode	OFF	ON	Half-Duplex fiber partner
FDX Mode	ON	OFF	Full-Duplex fiber partner (default)
Reserved	ON	ON	

* Should ONLY be used on 10FL series RuggedMC™ products.

The transparent mode can be utilized when BOTH the copper side and fiber side devices are capable of auto-negotiating duplex mode and speed as per TIA/EIA-785. When both partners are capable of negotiation, the RuggedMC™ can support 100BaseTx to 100BaseSX, full duplex, copper-to-fiber media conversion on 10FL standard electronics and fiber media. The TIA/EIA-785 standard allows for 10FL communication lines that are less than 300m in length to be upgraded to 100Mb/s communication links.

The HDX and FDX modes exist to accommodate fiber link partners that are operating in the forced mode. Due to the high number of forced full duplex fiber optical devices available, the factory default is the FDX, full duplex, mode.

3 Technical 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) ²	3 W
48 VDC	36 VDC	72 VDC	3.15A(T) ²	
HI (88/300 VDC) ¹ HI (120/240 VAC) ¹	88 VDC 85 VAC	300 VDC 264 VAC	3.15A(T) ²	

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

2 – (T) Denotes time-delay fuse

3.2 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	✓	✓	Full Duplex Operation
TIA/EIA 785	✓		10/100BaseSX Capable

All RuggedMC™ products feature Link Pass Through support. When loss of link is detected on either the fiber side or the copper side, link pulses are no longer transmitted on any of the RuggedMC™ ports. This feature allows for prompt loss of link detection and user correction. The faulty link partner can be identified by loss of link on the RuggedMC™ front panel indicators.

3.3 Copper Port Specifications

<i>Data Port</i>	<i>Media</i>	<i>Distance</i>	<i>Connector Type</i>
10/100 Mbps Auto-negotiating	Cat 5 UTP/STP	100m	RJ45

3.4 Fiber Optical Specifications

<i>Parameter</i>	<i>10Mbps Ports</i>		<i>100Mbps Ports</i>	
	<i>Multi-Mode</i>	<i>Single-Mode*</i>	<i>Multi-Mode</i>	<i>Single-Mode*</i>
Speed Standard	10BaseFL		100BaseFX	
Connector Type	ST		MTRJ	LC
Segment Length	2 km	15 km	2 km	15 km
Optical Wavelength	820nm	1310nm	1300nm	1310nm
Cable Size Core/Cladding	62.5/125µm	9/125µm	62.5/125µm	9/125µm
Optical Tx Power Min/Max (dBm Peak)	-13.5/-7.6	-23/-15	-16/-11	-15/-8
Optical Rx Sensitivity (dBm Average)	-34.4	-38	-33.5	-31
Max Optical Rx Power (dBm Peak)	-8.2	-3.0	-11	-5
Typical Optical Power Budget (dB)	22	18	17	16.5

* Available as an option

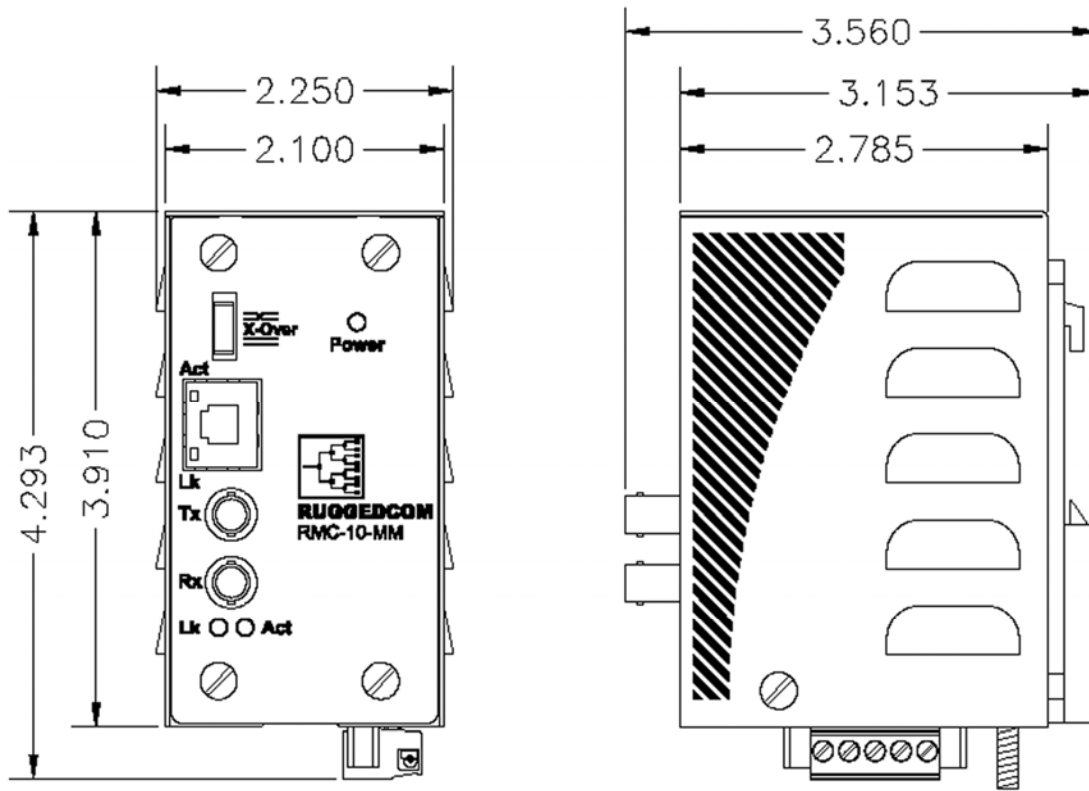
3.5 Networking Specifications

<i>Parameter</i>	<i>10FL Module</i>	<i>100FX Module</i>	<i>Notes</i>
Latency	1 µS	1 µS	Cut-through conversion

3.6 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	

3.7 Physical Dimensions



<i>Parameter</i>	<i>Value</i>	<i>Comments</i>
Dimensions	3.55 x 2.07 x 3.86 inches (90,35) x (52,59) x (98,04) mm	(Length x Width x Height)
Weight	1.5 lb (0,68 Kg)	
Enclosure	21 gauge Galvanized Steel	

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	Note 1
			1000 A/m for 1 s	5
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	N/A
IEC 61000-4-12	Damped Oscillatory	Signal ports	100% for 5 periods, 100% for 50 periods ²	N/A
		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 3 - IEC 61850-3 Type Tests

Note:

1. Ruggedcom specified severity levels

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 4 - 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 5 - 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>
cCSAus, CE	CSA C22.2 No. 60950, UL 60950, EN 60950, EN 61000-6-2	PENDING

6 Warranty

Five (5) years from date of purchase, return to factory. For warranty details, visit www.ruggedcom.com or contact your customer service representative.

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

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