RUGGEDCOM®
INDUSTRIAL STRENGTH NETWORKS™

RuggedBackbone™ RX5000

Hardware Installation Guide

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www.RuggedCom.com

RuggedBackbone™ RX5000: Hardware Installation Guide

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Contacting RuggedCom

Corporate Headquarters	US Headquarters	Europe Headquarters
RuggedCom Inc. 300 Applewood Cres., Unit 1, Concord, Ontario Canada, L4K 5C7 Tel: +1 905 856 5288 Fax: +1 905 856 1995 Toll-free: 1 888 264 0006	RuggedCom 1930 Harrison St., Suite 209 Hollywood, Florida USA, 33020 Tel: +1 954 922 7938 ext.103 Fax: +1 954 922 7984 Toll-free: 1 888 264 0006	RuggedCom Unit 41, Aztec Centre, Aztec West, Almondsbury, Bristol United Kingdom BS32 4TD Tel: +44 1454 203 404 Fax: +44 1454 203 403
Email: RuggedSales@RuggedCom.com		

Technical Support
Toll Free (North America): 1 866 922 7975 International: +1 905 856 5288 Email: Support@RuggedCom.com

Web: www.RuggedCom.com

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FCC Statement And Cautions

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.

CAUTION: LASER

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.

CAUTION: Service

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 RuggedCom Inc. could invalidate specifications, test results, and agency approvals, and void the user's authority to operate the equipment.

Should this device require service, please refer to Chapter 7, Warranty in this guide.

CAUTION: Physical Access

This product 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.

CAUTION: Hot Surface

Avoid contact with the surface of the unit. The metal surface may be hot due to the high allowable ambient temperature per specification.

ATTENTION: Surface Chaude

Éviter tout contact avec la surface. La surface métallique peut être chaude a cause d'une température ambiante élevée selon les spécifications. S.V.P. se référer à la version française de ce guide pour les détails.

1. Product Overview

1.1. Functional Overview

The RuggedBackbone™ RX5000 is a high-port density routing and switching platform, designed to operate in harsh environments. The RX5000 can withstand high levels of electromagnetic interference, radio frequency interference, and a wide temperature range of -40°C to +85°C. This platform is designed to meet the challenging climatic and environmental demands found in utility, industrial and military network applications.

The RX5000's superior ruggedized hardware design, coupled with the embedded ROX™ operating system provides improved system reliability when your network needs it the most. The cyber security and networking features make it ideally suited for creating secure Ethernet networks for mission critical, real-time, control applications.

The RX5000 is a scalable, hot-swappable, modular platform which provides its users with the ability to change the RuggedBackbone™ as their network grows or their needs change.

The RuggedEnclosure™ is rated for IP65 ingress protection, meaning that it is dust tight and can withstand water from a nozzle in any direction. Constructed with aluminum extrusions with fins on both sides combined with high reliability internal circulation fans optimizes heat transfer without exchange of outside air and improves MTBF for the enclosed electronics.

The combination of the RuggedEnclosure™ and the MX5000 RuggedBackbone™ provides an extremely flexible package that has MIL-STD approvals and continues RuggedCom's tradition of pioneering advanced networking solutions specifically for the harsh environments found in military applications.

1.2. Feature Highlights

Ethernet Ports

- Up to 96 10/100TX + 2 10/100/1000TX copper ports
- Up to 48 100FX optical ports
- Up to 2 Gigabit Ethernet ports
- Long-haul optics allow distances up to 90km
- Multiple connector types (ST, MTRJ, LC, SC)

Cyber Security Features

- Multi-level passwords
- SSH/SSL encryption
- Enable/disable ports, MAC based port security
- Port based network access control (802.1x)
- VLAN (802.1Q) to segregate and secure network traffic

RuggedRated™ for Reliability in Harsh Environments

- Immunity to EMI and high voltage electrical transients:
  - Zero-Packet-Loss Technology

  - Meets IEEE 1613 (electric utility substations)
  - Exceeds IEC 61850-3 (electric utility substations)
  - Exceeds IEC 61800-3 (variable speed drive systems)
  - Exceeds IEC 61000-6-2 (generic industrial environment)
- -40°C to +85°C operating temperature (no fans)
- Conformal coated printed circuit boards (optional)

ROX™ Software Features

- Next Generation of ROX™ (Rugged Operating System on LinuX)
- Simple plug and play operation – automatic learning, negotiation, and crossover detection
- MSTP (Multiple Spanning Tree Protocol - 802.1Q-2005 - formerly 802.1s)
- RSTP (Rapid Spanning Tree protocol - 802.1w) and eRSTP™ (Enhanced Rapid Spanning Tree Protocol) network fault recovery
- QoS (Quality of Service - 802.1p) for real-time traffic
- VLAN (Virtual LAN - 802.1Q) with double tagging and GVRP (GARP VLAN Registration Protocol) support
- GMRP (GARP Multicast Registration Protocol - 802.1D) and GMVP services
- Link aggregation (802.3ad)
- Traffic prioritization
- Transaction based configuration with rollback
- Telecom-style CLI (Command Line Interface)

Management Tools

- Web-based interface
- Telecom-style CLI
- SNMP v1/v2c
- Rich set of diagnostics with configurable logging
- NETCONF
- RBAC (Role-Based Access Control)

Modularity

- Up to 6 slots for line modules
- Up to 96 10/100TX or 48 100FX ports

Universal Power Supply Options

- Fully integrated, dual-redundant (optional) power supplies
- Universal high voltage ranges: 88-300VDC or 85-264VAC
- Terminal blocks for reliable maintenance-free connections
- CSA/UL 60950 safety approved to 85°C

2. RuggedBackbone™ Modules

The RX5000 chassis comprises ten slots, each one of which is designed to accommodate a particular module. Figure 2.1 shows the rear panel view of the RX5000. The slot name at each position (“PM1”, “L1”, etc.) denotes the type of module that may be installed at that position in the chassis.

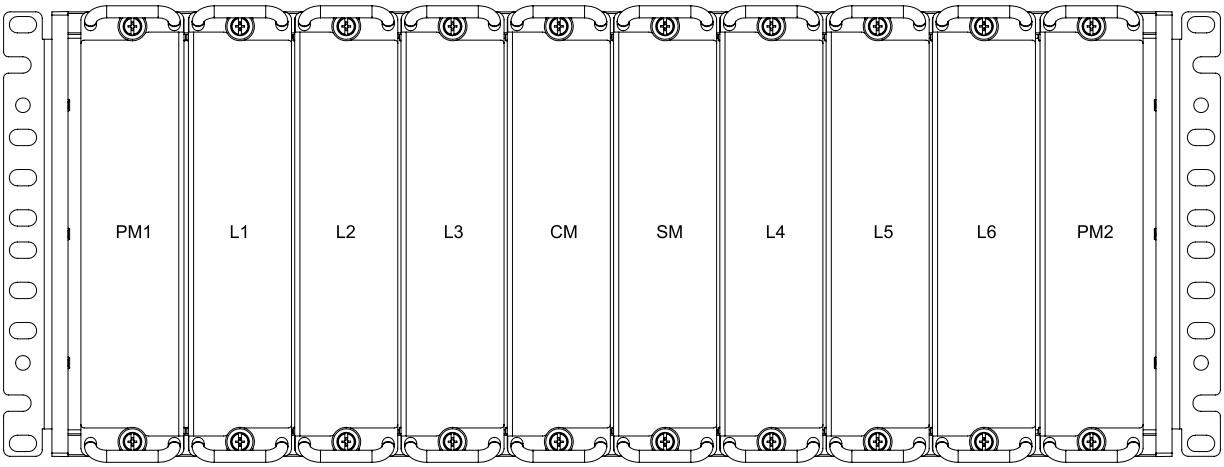

Figure 2.1. Chassis Slot Assignment

The slot name markings in the diagram above represent the following RuggedBackbone™ modules:

CM

The *Control Module* is the central processing unit of the system. Refer to Section 2.2: Control Module for detail.

SM

The *Switch Module* contains the chassis-wide Ethernet switch fabric that interconnects Ethernet ports on all installed line modules. Refer to Section 2.3: Switch Module for detail.

L1..L6

One or more Line Module cards may be installed - refer to Section 2.4: Line Modules for detail.

PM1, PM2

Dual, redundant, power supply modules may be installed - refer to Section 2.5: Power Module for detail.

All supported modules are built to the RuggedRated™ specifications of the RuggedBackbone™ RX5000. Each of the module types is detailed in the following sections.

2.1. Installing A Module In The Chassis

In order to install a module into the RuggedBackbone™ chassis, align the module guide ribs with the channels on the chassis, and push the module in as far as it will go. There is a detent position that must be pushed through to properly seat the connectors - this is the added resistance from the grounding springs. When properly seated, the module flange will rest on the main chassis frame. Tighten the thumbscrews using finger strength only.

2.2. Control Module

The Control Module (CM) is the central processing unit of the RuggedBackbone™ chassis. The ROX™ operating system running on the CM controls and coordinates the functions of all modules installed in the system. The Control Module is installed in the CM slot of the chassis, as shown in Figure 2.1, “Chassis Slot Assignment”.

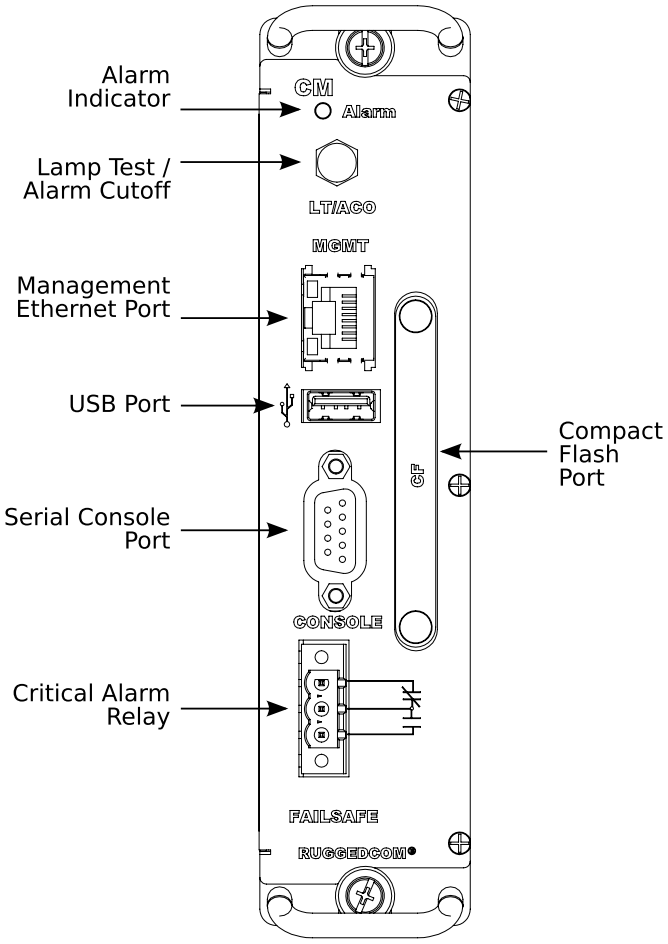

Figure 2.2. Control Module

The CM is equipped with an RS232 serial console port for initial management functions, and a locally connected 10/100Base-T Ethernet port for system management out of band from the switch fabric.

Other features of the CM include:

- Alarm Indicator LED, which indicates system alarm status.
- Removable 1GB Compact Flash (CF) card, which contains active and fallback installations of the ROX™ operating system, along with the configuration database and other system data.
- Critical Alarm Relay, activated by the operating system to indicate a critical alarm.
- Lamp Test / Alarm Cutoff button.
- Utility USB port (as yet unused).

Detailed information on connecting to the ports on the CM can be found in this guide as follows:

- Serial Console: Section 3.4, “Serial Console Ports”
- Management Ethernet Interface: Section 3.5, “Copper Ethernet Ports”
- Critical Alarm (Failsafe) Relay Interface: Section 3.3, “Critical Alarm Relay”

2.3. Switch Module

The Switch Module (SM) is the Ethernet switch fabric central to the RuggedBackbone™ RX5000. It provides one Gbps of bandwidth to each installed Line Module and two 1Gbps ports to (optional) connectors on its own faceplate. The Switch Module is installed in the SM slot of the chassis, as shown in Figure 2.1, “Chassis Slot Assignment”.

Switch Modules may be ordered as separate components with copper, LC fiber, or with no Ethernet ports. Refer to the RuggedBackbone™ RX5000 data sheet for complete ordering details.

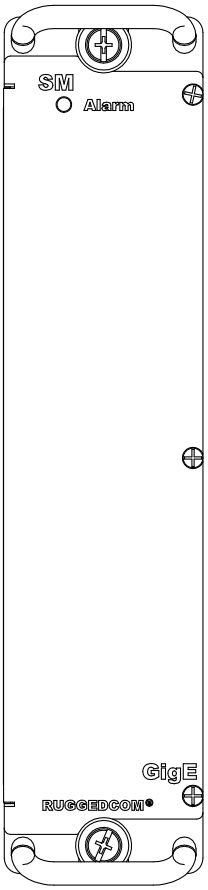

Figure 2.3. Switch Module - No Ports

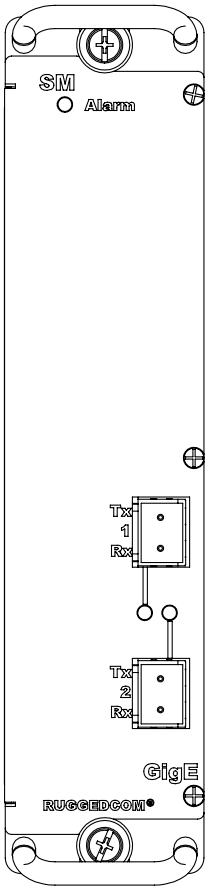

Figure 2.4. Switch Module - Fiber (LC)

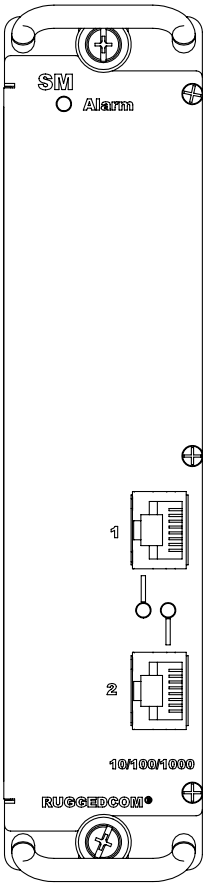

Figure 2.5. Switch Module - Copper

2.4. Line Modules

The RuggedBackbone™ RX5000 may be configured with up to six Line Module (LM) cards, in the LM1 through LM6 slots of the chassis, as shown in Figure 2.1, “Chassis Slot Assignment”. Different Line Modules are available depending on the required type and number of Ethernet ports:

- Four or eight port 10/100 BaseTX RJ45 (copper)
- Four or eight port 100FX single- or multi-mode fiber
- Four port 10/100/1000 BaseTX RJ45 (copper)
- Four port 1000LX single- or multi-mode fiber

Refer to the RuggedBackbone™ RX5000 datasheet for complete ordering details.

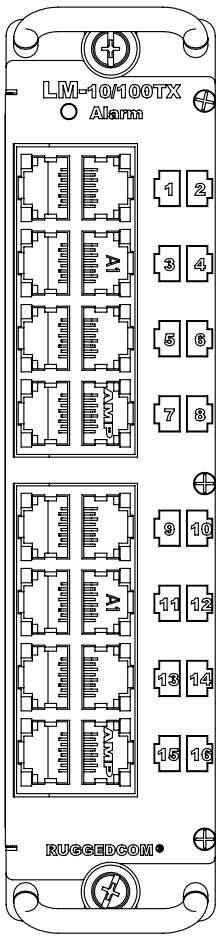

Figure 2.6. 16TX01 - 16 RJ45 Ports

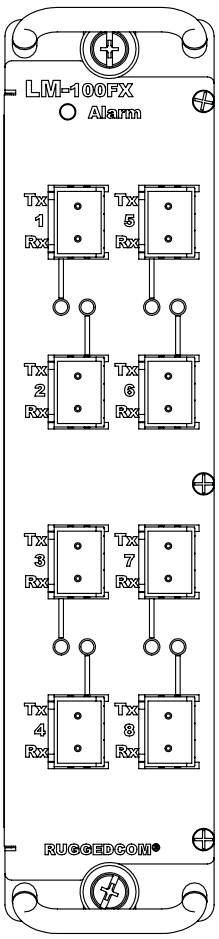

Figure 2.7. 8FX11 - 8 LC Fiber Ports

2.5. Power Module

The RuggedBackbone™ RX5000 may be equipped with either one or two Power Modules (PM). Not only do two power supplies provide redundancy, but the RX5000 is also able to balance the load it places on each one.

Each Power Module is capable of delivering a maximum of 100W, and accepts either AC or DC power at its input. Power Supply Modules are installed in the PM1 or PM2 slots of the chassis, as shown in the Figure 2.1, “Chassis Slot Assignment” diagram.

Power Supply Modules may be ordered as separate components. Refer to the RuggedBackbone™ RX5000 datasheet for complete ordering details.

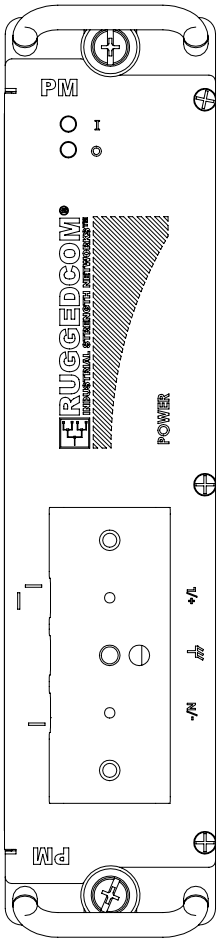

Figure 2.8. Power Supply Module

3. Installation

3.1. Mounting

The RuggedBackbone™ RX5000 has been designed to provide the greatest possible flexibility in display configuration and mounting. Hardware is provided to adapt the chassis for mounting to a panel or to a standard 19" rack.

3.1.1. Rack Mounting

The first step in mounting the RX5000 to a 19" rack is to assemble the handle and rack mount bracket using two (2) #10-32 × 3/8" flat head steel screws (supplied) as shown. Screws are to be torqued to 18±1 in-lb.

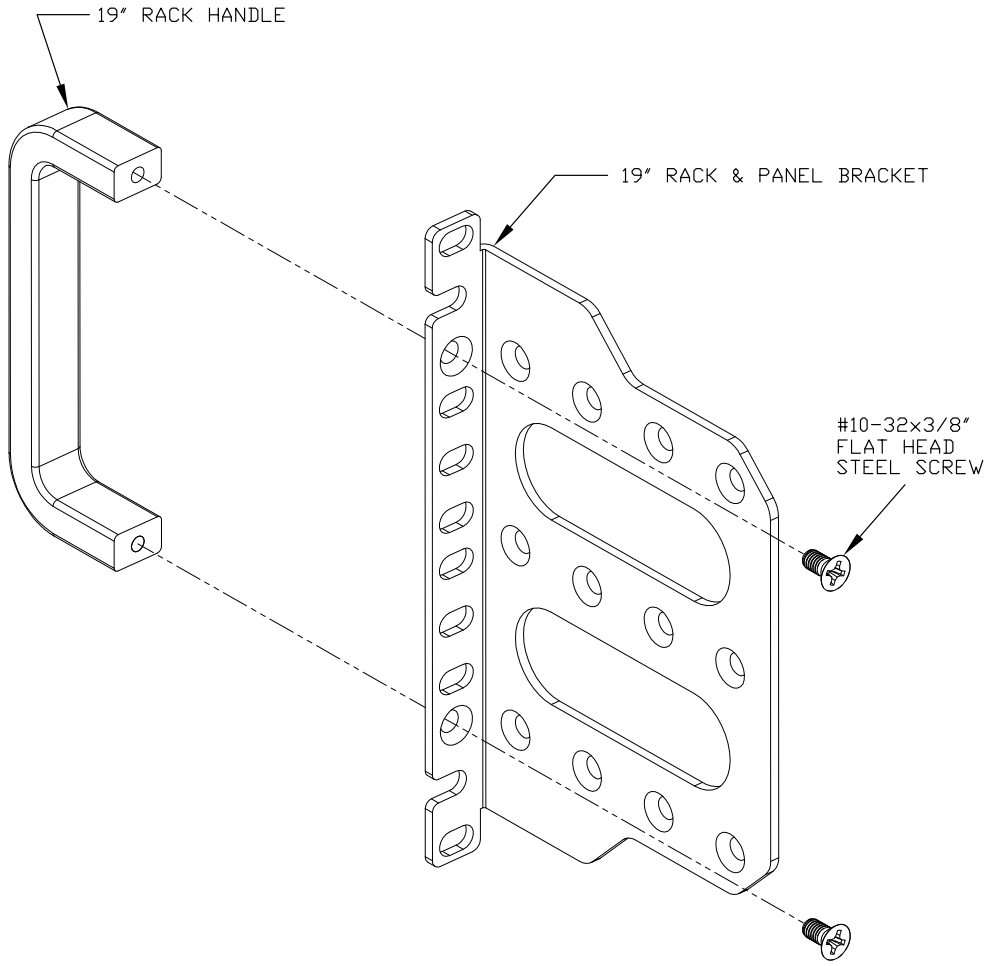

Figure 3.1. Rack Mount Assembly Step 1

3.1.1.1. Rack Front Mounting

Assemble the rack mount brackets to the main chassis using six (6) #10-32 × 3/8" flat head steel screws (supplied) on each side. Screws are to be torqued to 18±1 in-lb. The brackets may be mounted either as shown above, or extended by 1".

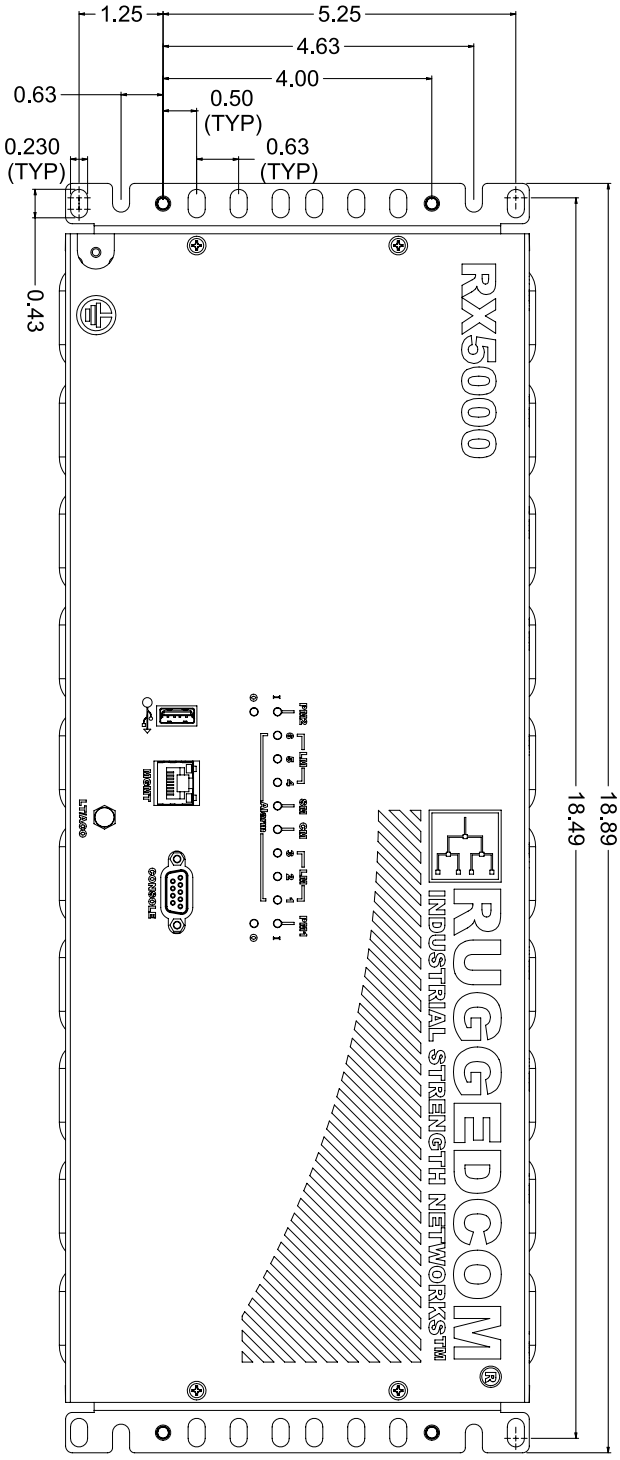

Figure 3.2. Rack Front Mount - Front View

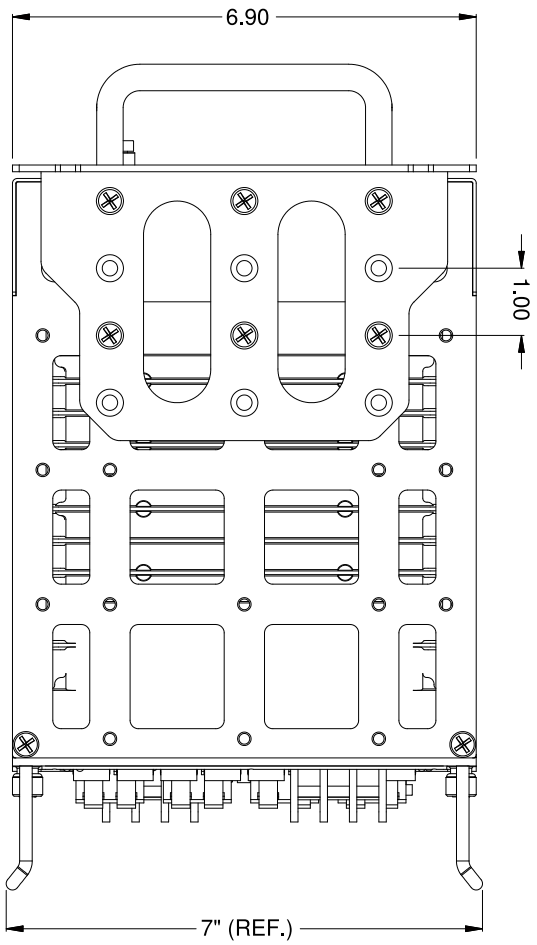

Figure 3.3. Rack Front Mount - Side View

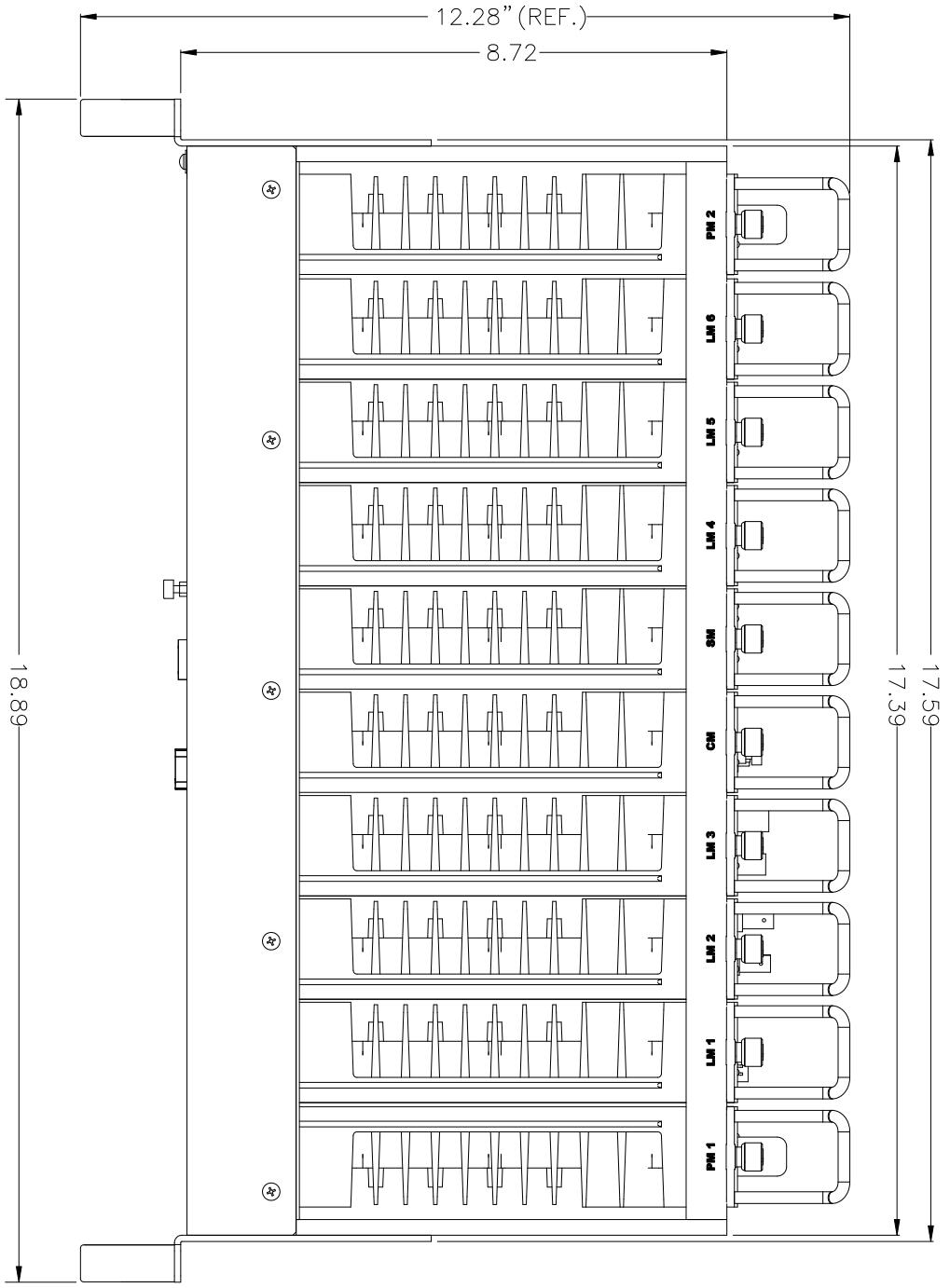

Figure 3.4. Rack Front Mount - Top View

3.1.1.2. Rack Front Mounting with Front-Mounted Power Supplies

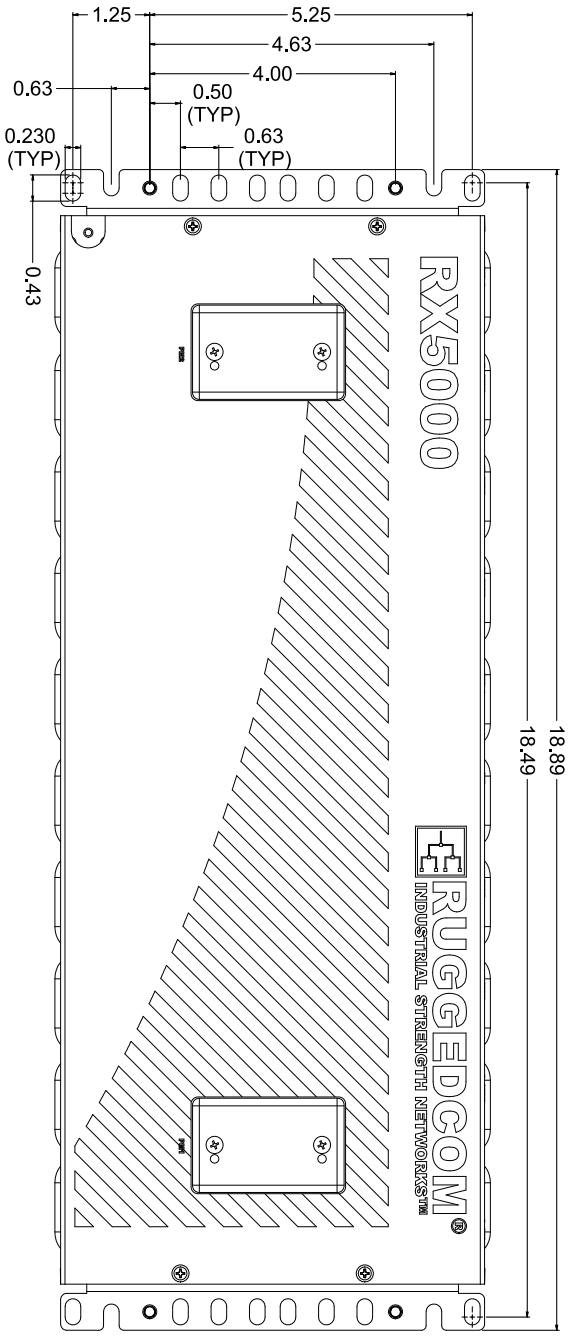

Figure 3.5. Rack Front Mount with Front-Mount Power Supplies - Front View

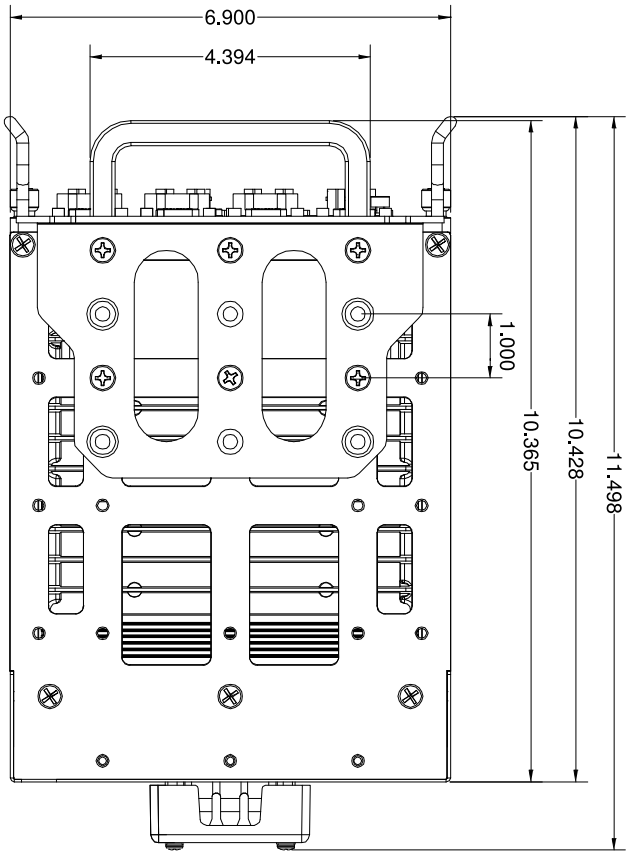

Figure 3.6. Rack Front Mount with Front-Mount Power Supplies - Side View

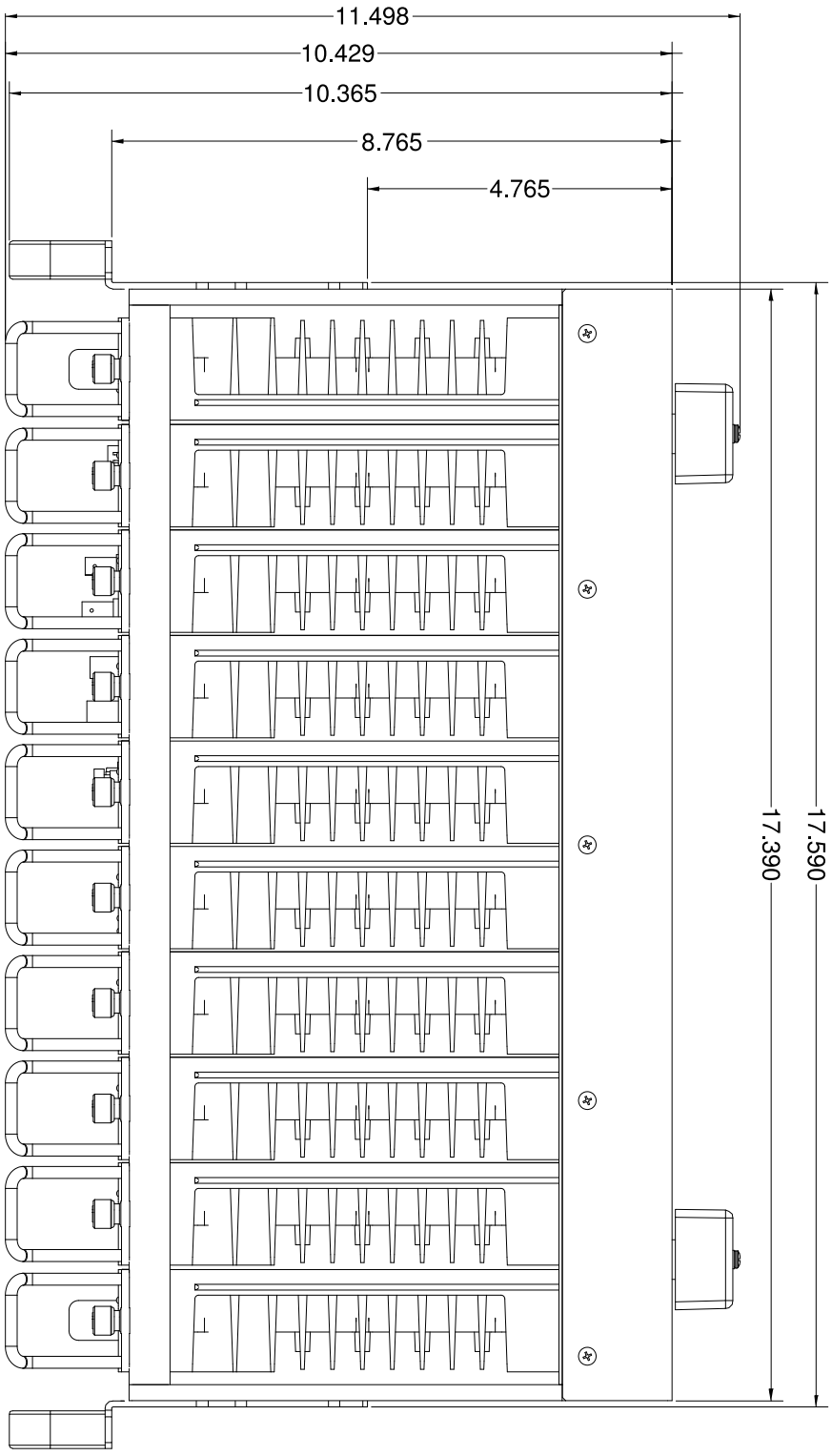

Figure 3.7. Rack Front Mount with Front-Mount Power Supplies - Top View

3.1.1.3. Rack Rear Mounting

Assemble the rack mount brackets to the main chassis using six (6) #10-32 × 3/8" flat head steel screws (supplied) on each side. Screws are to be torqued to 18±1 in-lb. The brackets may be mounted either as shown above, or extended by 1".

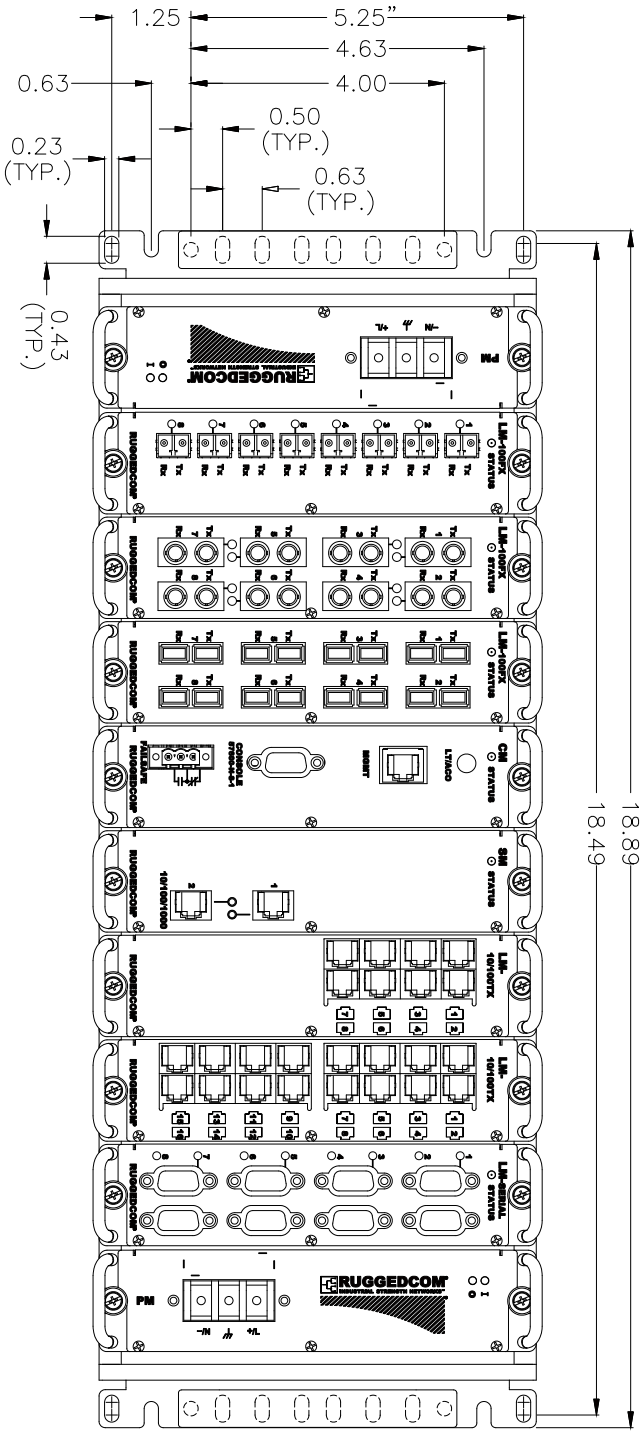

Figure 3.8. Rack Rear Mount - Rear View

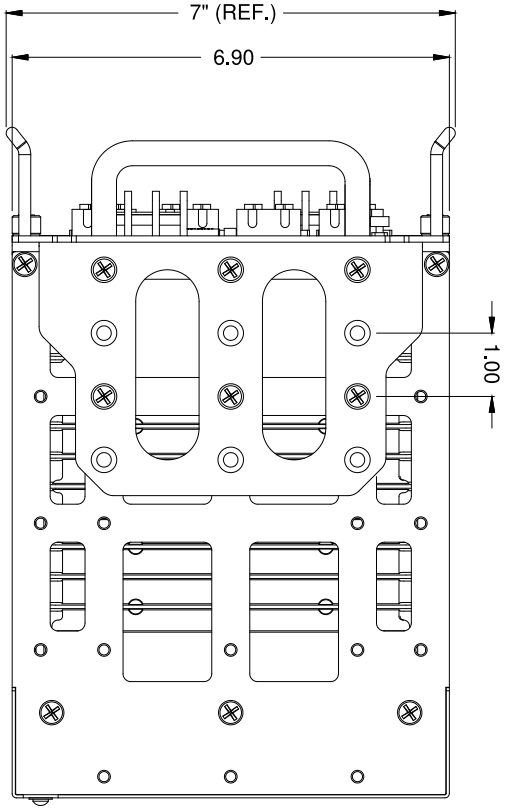

Figure 3.9. Rack Rear Mount - Side View

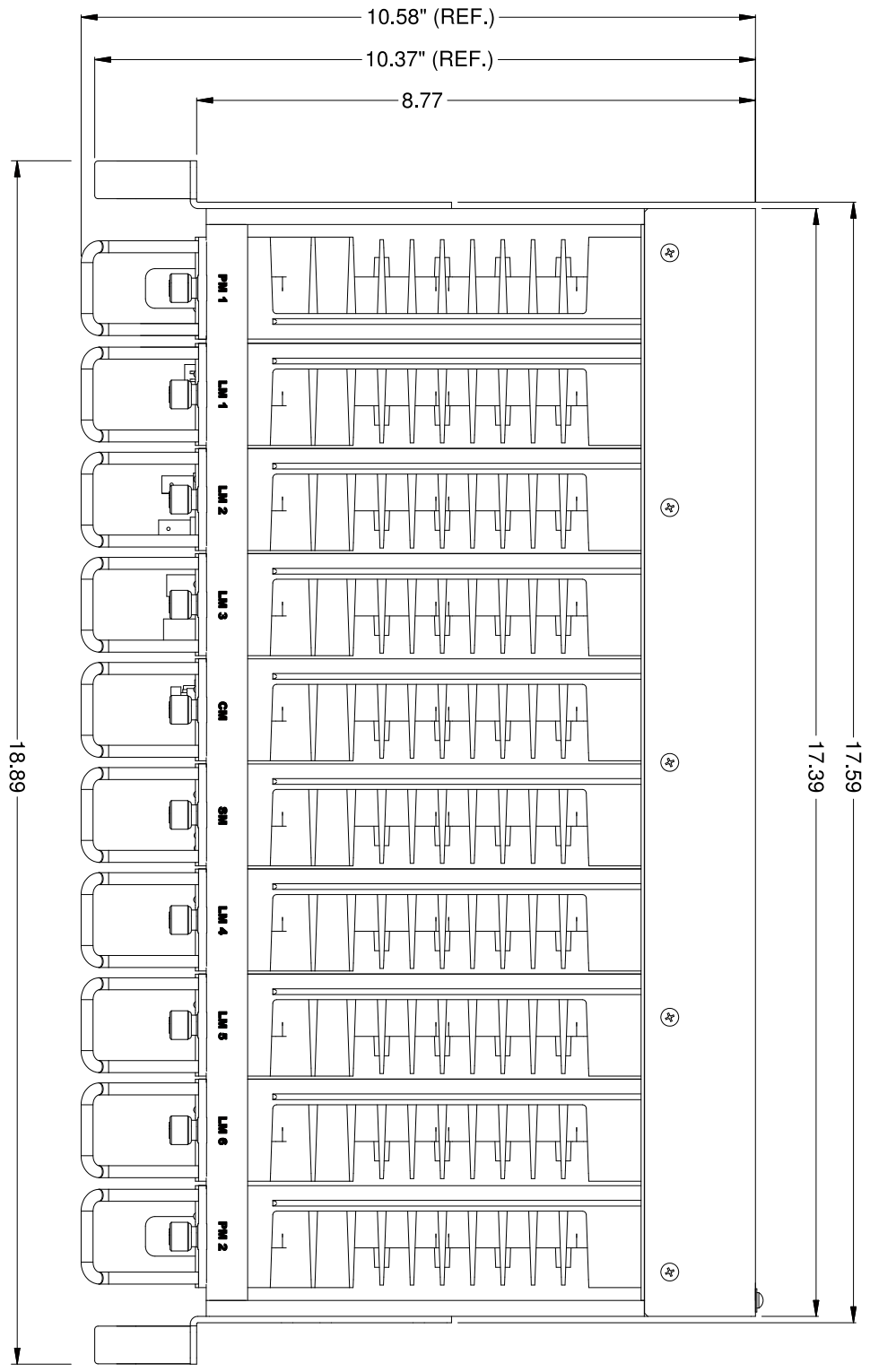

Figure 3.10. Rack Rear Mount - Top View

3.1.2. Panel Mounting

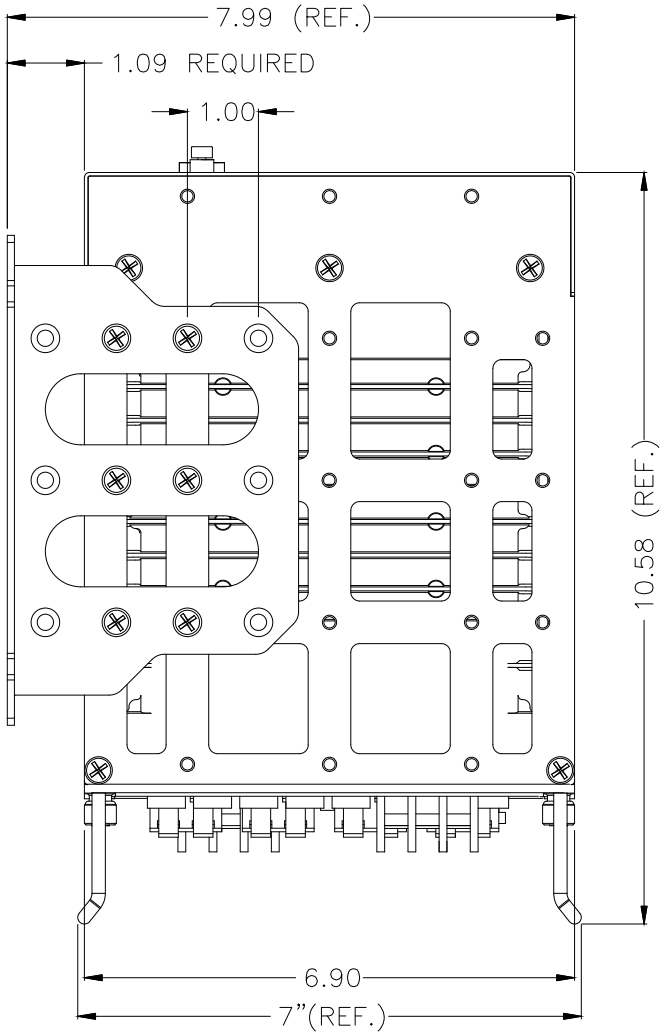

Figure 3.11. Panel Mount - Side View

The RX5000 may be fastened to panel mount brackets in one of the two positions shown above.

Assemble the panel mount brackets to the main chassis using six (6) #10-32 × 3/8" flat head steel screws (supplied) on each side. Screws are to be torqued to 18±1 in-lb.

3.2. Power Supply Wiring And Grounding

The RuggedBackbone™ RX5000 may be ordered with dual redundant power supplies, in positions PM1 and PM2 (see Figure 2.1, “Chassis Slot Assignment”). Power connections are located either on the PM1 and PM2 module face plates or on the front panel of the RX5000. An optional chassis ground connection is located on the front panel as pictured in AC Power - Separate Earth Connection.

Each RX5000 Power Module is equipped with a Phillips screw terminal block (Figure 3.12) for main power connection. The Phillips Screw Terminal Block has Phillips screws with compression plates, allowing either bare wire connections or crimped terminal lugs. We recommend the use of #6 size ring lugs to ensure secure, reliable connections under severe shock or vibration. The terminal block has a safety cover which must be removed via two Phillips screws before connecting any wires. The safety cover must be reattached after wiring to ensure personnel safety.

A permanently connected RuggedBackbone™ RX5000 must have a readily accessible disconnect device incorporated external to the equipment.

The RX5000 may have two (2) power supplies installed and be supplied from multiple power sources. Service personnel must isolate both power supplies prior to servicing.

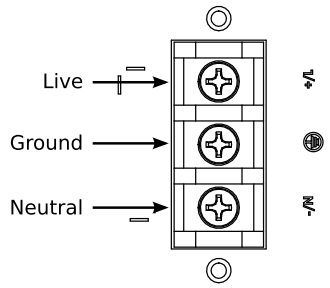

Figure 3.12. RX5000 Power Connector

Pin	Function
+/L	Live
⏚	Ground
-/N	Neutral

Table 3.1. RX5000 Power Connector Pinout

The following sections illustrate methods of connecting power to the RuggedBackbone™ RX5000.

3.2.1. DC Power Supply Wiring

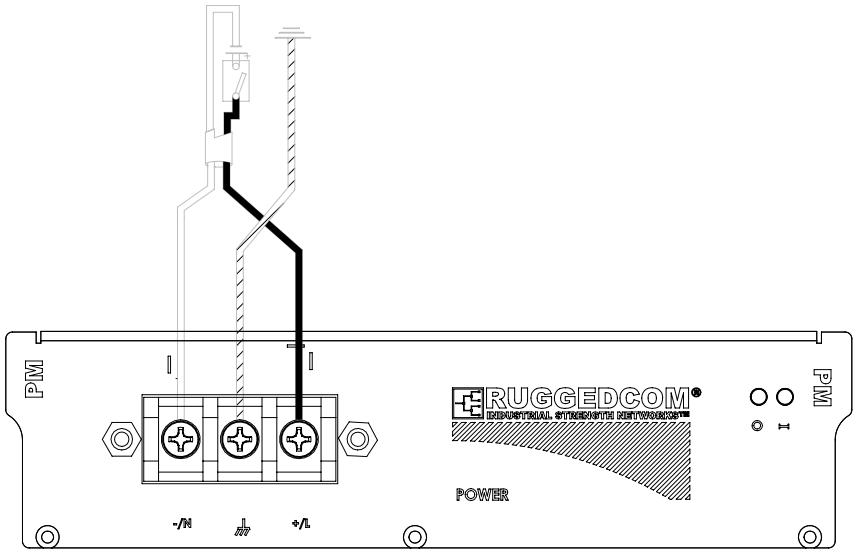

Figure 3.13. DC Power Connection

3.2.2. AC Power Supply Wiring

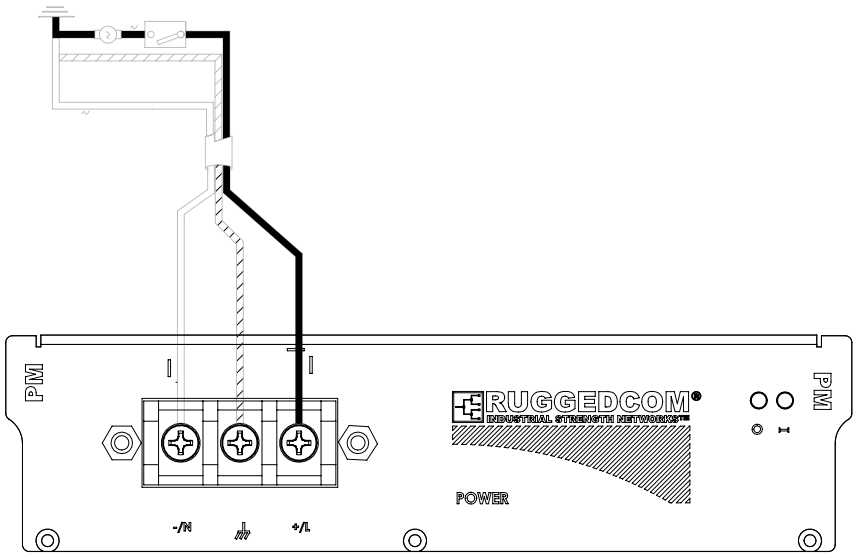

Figure 3.14. AC Power - Integrated Earth Connection

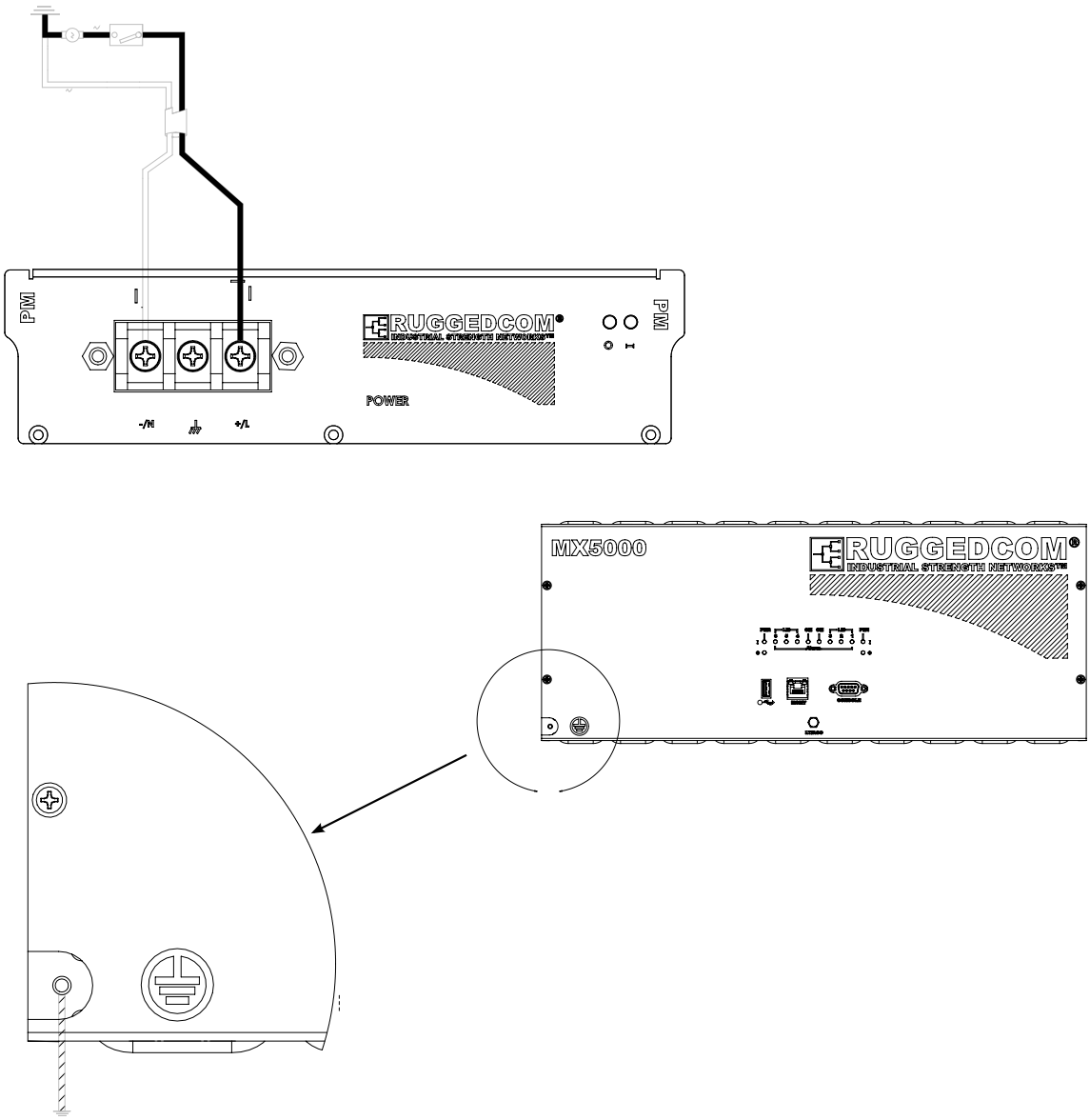

Figure 3.15. AC Power - Separate Earth Connection

> *If the ground terminal on the Figure 3.12, "RX5000 Power Connector" is not connected to safety earth, a connection must be provided from the chassis ground terminal, shown above.*

3.3. Critical Alarm Relay

The Critical Alarm output relay signals critical error conditions that may occur on the RuggedBackbone™ RX5000. The contacts are energized upon power-up of the unit and remain energized unless a critical alarm condition is detected. Relay connections are shown in the Critical Alarm Relay Connection diagram. Control of the relay output may be configured via the ROX™ user interface.

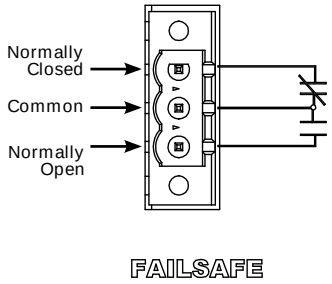

Figure 3.16. Critical Alarm Relay Connection

Pin	Function
NC	Normally Closed
Common	Ground
NO	Normally Open

Table 3.2. RX5000 Critical Alarm Relay Connector Pinout

A common application for this output is to signal an alarm in case of a power failure.

3.4. Serial Console Ports

The serial console port on the CM provides access to the boot-time control and configuration menu interface. Both the CM serial console port and the one on the front panel of the RX5000 chassis provide a console interface to the ROX™ operating system.

The serial ports implement RS232 DCE on a female DB9 connector. Serial settings are: 57600 bps, 8 bits, No parity, 1 stop bit. The pin assignment of both console ports is given in the Table 3.3, "Serial Console Pinout" table.

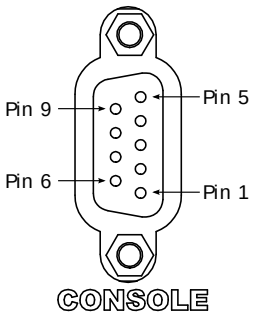

Figure 3.17. Serial Console Port

Pin	Function
1	DCD [1]
2	RX
3	TX
4	DTR[1]
5	GND
6	DSR[1]
7	RTS [2]
8	CTS[2]
9	NC

[1] DCD, DTR, and DSR are looped back internally.

[2] RTS and CTS are looped back internally.

Table 3.3. Serial Console Pinout

3.5. Copper Ethernet Ports

The RuggedBackbone™ RX5000 can be ordered with up to 96 10/100Base-TX ports that allow connection to standard CAT-5 UTP cable with RJ45 male connectors. All copper Ethernet ports feature auto-negotiation, auto-polarity, and auto-crossover functions. The female RJ45 connector can accept and take advantage of screened (commonly known as "shielded") cabling.

3.5.1. RJ45 Twisted-Pair Copper Ports

Female RJ45 connectors are available on LMs that support 10/100Base-T and on LMs and SMs that support 10/100/1000Base-T Ethernet. Their pin assignments are described below.

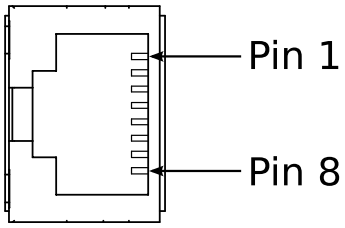

Figure 3.18. RJ45 Ethernet Jack

RJ45 Pin	10/100Base-Tx	10/100/1000Base-Tx
1	RX+	A+
2	RX-	A-
3	TX+	B+
4	NC	C+
5	NC	C-
6	TX-	B-
7	NC	D+
8	NC	D-

Table 3.4. RJ45 Ethernet Pinout

3.5.2. 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 meters using 4 pairs of 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. To ensure reliable, error-free data communications, new and preexisting communication paths should be verified for TIA/EIA-568-A compliance. The table: Cabling Categories And 1000Base-TX Compliance summarizes the relevant cabling standards as they apply to 100Base-TX connections.

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

Table 3.5. Cabling Categories And 1000Base-TX Compliance

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

- Data cable lengths should be as short as possible - ideally limited to 3m (10') 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.

- Shielded/screened cabling can optionally be used. The cable shield should be grounded at one single point to avoid the generation of ground loops.

3.5.3. Transient Suppression

All copper Ethernet ports on RuggedCom products include transient suppression circuitry to protect against damage from electrical transients and to ensure conformance to IEC 61850-3 and IEEE 1613 Class 1. This means that during a transient electrical event, it is possible for communications errors or interruptions to occur, but recovery is automatic.

RuggedCom does not recommend the use of copper cabling of any length for critical, real-time, substation automation applications.

RuggedCom also recommends against the use of copper Ethernet connections to interface to devices in the field across distances which could produce high levels of ground potential rise, i.e. greater than 2500V, during line-to-ground fault conditions.

3.6. Fiber Ethernet Ports

Depending on the order code of the product, the RuggedBackbone™ RX5000 can be equipped with LMs and SMs with several different types of fiber optic ports. The Transmit (TX) and Receive (RX) connections of each port must be properly connected and matched for proper link establishment and operation. The drawings in the following figures show a side and top view of each supported fiber optic connector type to assist in identifying the proper cable connection orientation.

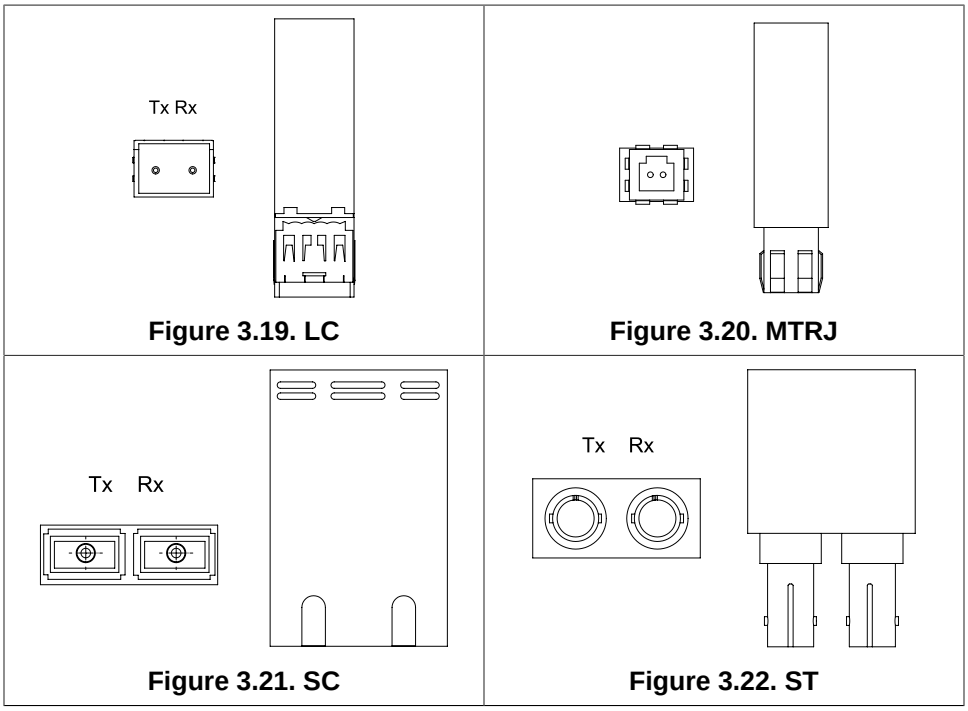

Figure 3.19. LC

Figure 3.20. MTRJ

Figure 3.21. SC

Figure 3.22. ST

Table 3.6. Available Fiber Connector Types

4. Technical Specifications

4.1. Power Supply Specifications

Power Supply Type	Input Range		Internal Fuse Rating	Max. Power Consumption[a]
	Min	Max		
HI (125/250 VDC)[b]	88 VDC	300 VDC	6.3A, 250V(T)[c]	84 W[d]
HI (110/230 VAC)[b]	85 VAC	264 VAC	6.3A, 250V(T)[c]	84 W[d]

[a] Power consumption varies based on configuration, i.e. the number and type of ports. Each 10/100Base-TX port consumes roughly 1W less than a fiber optic port.

[b] The “HI” power supply is the same power supply for both AC and DC.

[c] (T) denotes time-delay fuse. Internal fuse is not user-replaceable.

[d] Rating at 85°C ambient temperature at worst-case load.

Table 4.1. Power Supply Specifications

4.2. Critical Alarm Relay Specifications

Parameter	Value (Resistive Load)
Max Switching Voltage	250 VAC, 125 VDC
Rated Switching Current	2A@250VAC, 2A@30VDC

Table 4.2. Critical Alarm Relay Specifications

4.3. Copper Ethernet Port Specifications

The RX5000 can be ordered with several different modules which contain 10/100Tx or 10/100/1000Tx Ethernet ports. All copper Ethernet ports have the following specifications:

Parameter	Specification	Notes
Speed	10/100 or 10/100/1000 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	100 m	
Connector	RJ45	
Isolation	1.5kV	RMS 1-minute

Table 4.3. Copper Ethernet Port Specifications

4.4. Fiber Ethernet Port Specifications

The following sections detail fiber optic specifications of ports that can be ordered with the modules on a RuggedBackbone™ RX5000. The user determines the type of optics at time of ordering, and can determine the modules installed on a particular unit by reading the factory data file via the ROX™ user interface. Section 4.4.1, “Fast Ethernet (100Mbps) Optical Specifications” and Section 4.4.2, “Gigabit Ethernet (1Gbps) Optical Specifications” list the specifications of the optical transceivers used in the fiber Ethernet modules available for the RX5000. The specifications are organized by signaling speed and then by order code. Module order codes are contained within each unit when it is assembled and configured at the factory. Consult the RuggedCom ROX™ User Guide for help in obtaining the factory configuration data.

4.4.1. Fast Ethernet (100Mbps) Optical Specifications

Order Code	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)
FX01	MM	ST	62.5/125	1300	-19	-14	-31	-14	2	12
			50/125		-22.5					8.5
FX02	MM	SC	62.5/125	1300	-19	-14	-31	-14	2	12
			50/125		-22.5					8.5
FX11	MM	LC	62.5/125	1300	-19	-14	-32	-14	2	13
FX03	MM	MTRJ	62.5/125	1300	-19	-14	-31	-14	2	12
			50/125		-22.5					8.5
FX04	SM	ST	9/125	1310	-15	-8	-32	-3	20	17
FX05	SM	SC	9/125	1310	-15	-8	-31	-7	20	16
FX06	SM	LC	9/125	1310	-15	-8	-34	-7	20	19
FX07	SM	SC	9/125	1310	-5	0	-34	-3	50	29
FX08	SM	LC	9/125	1310	-5	0	-35	3	50	30
FX09	SM	SC	9/125	1310	0	5	-37	0	90	37
FX10	SM	LC	9/125	1310	0	5	-37	0	90	37

Table 4.4. Fast Ethernet (100Mbps) Optical Specifications

4.4.2. Gigabit Ethernet (1Gbps) Optical Specifications

Order Code	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)
SM04	MM	LC	50/125	850	-9	-2.5	-20	0	0.5	11
			62.5/125							
SM05	SM	SC	9/125	1310	-10	-3	-20	-3	10	10
SM06	SM	LC	9/125	1310	-9.5	-3	-21	-3	10	11.5
SM07	SM	SC	9/125	1310	-5	0	-20	-3	25	15
SM08	SM	LC	9/125	1310	-7	-3	-24	-3	25	17

Table 4.5. Gigabit Ethernet (1Gbps) Optical Specifications

4.5. Operating Environment

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

Table 4.6. Operating Environment

4.6. Mechanical Specifications

Parameter	Value	Comments
Dimensions	6.9 x 17.9 x 11.89 inches (175.26 x 454.66 x 302.01 mm)	(Height x Width x Depth)
Weight	Variable	Weight dependent on module complement.
Ingress Protection	IP40	(1 mm objects)
Enclosure	Aluminum	

Table 4.7. Mechanical Specifications

5. EMI And Environmental 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	+/- 4kV @ 2.5kHz	Note[a]
		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	Note[a]
			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
		A.C. Power ports	30% for 1 period, 60% for 50 periods	N/A
IEC 61000-4-11	Voltage Dips & Interrupts	A.C. Power ports	100% for 5 periods, 100% for 50 periods	N/A
IEC 61000-4-12	Damped Oscillatory	Signal ports	2.5kV common, 1kV diff. mode@1MHz	3
		D.C. Power ports	2.5kV common, 1kV diff. mode@1MHz	3
		A.C. Power ports	2.5kV common, 1kV diff. 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	2kVAC (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

[a] RuggedCom-specified severity levels

Table 5.1. IEC 61850-3 EMI Type Tests

Test	Description		Test Levels
IEEE C37.90.3	ESD	Enclosure Contact	+/-2kV, +/-4kV, +/- 8kV
		Enclosure Air	+/-4kV, +/-8kV, +/-15kV
IEEE C37.90.2	Radiated RFI	Enclosure ports	35 V/m
IEEE C37.90.1	Fast Transient	Signal ports	+/- 4kV @ 2.5kHz
		D.C. Power ports	+/- 4kV
		A.C. Power ports	+/- 4kV
		Earth ground ports	+/- 4kV
IEEE C37.90.1	Oscillatory	Signal ports	2.5kV common mode @1MHz
		D.C. Power ports	2.5kV common, 1kV diff. mode@1MHz
		A.C. Power ports	2.5kV common, 1kV diff. mode@1MHz
IEEE C37.90	H.V. Impulse	Signal ports	5kV (Fail-Safe Relay output)
		D.C. Power ports	5kV
		A.C. Power ports	5kV
IEEE C37.90	Dielectric Strength	Signal ports	2kVAC
		D.C. Power ports	2kVDC
		A.C. Power ports	2kVAC

Table 5.2. IEEE 1613 (C37.90.x) EMI Immunity Type Tests[a]

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

Table 5.3. Environmental Type Tests

6. Agency Approvals

Agency	Standards	Comments
Canada (cTUVus)	CAN/CSA C22.2 No. 60950-1-07	Pending
USA (NRTL - cTUVus)	UL 60950-1:2007	Pending
CE	EN 60950, EN 61000-6-2	CE Compliance is claimed via Declaration of Self Conformity Route
FCC	FCC Part 15, Class A	Pending
CISPR	EN55022, Class A	Pending
FDA/CDRH	21 CFR Chapter 1, Subchapter J	Pending
ISO	ISO9001:2000	Designed and manufactured using a ISO9001: 2000 certified quality program

Table 6.1. Agency Approvals

7. Warranty

RuggedCom warrants this product for a period of five (5) years from the date of purchase. This product contains no user-serviceable parts. Attempted service by unauthorized personnel shall render all warranties null and void. For warranty details, visit www.RuggedCom.com or contact your customer service representative.

Should this product require service, contact the factory at:

RuggedCom Inc.
300 Applewood Crescent
Concord, Ontario
Canada L4K 5C7
Phone: +1 905 856 5288
Fax: +1 905 856 1995